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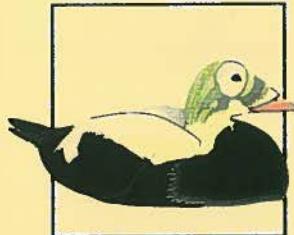
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Technical Report WAES-TR-97-03



Habitat
Conservation

Environmental Contaminants in Three Eider Species from Alaska and Arctic Russia



Endangered
Species

*by:
Kimberly A. Trust
Jean F. Cochrane
Jordan H. Stout*



Environmental
Contaminants

December 1997

**ENVIRONMENTAL CONTAMINANTS IN THREE EIDER SPECIES
FROM ALASKA AND ARCTIC RUSSIA**

Kimberly A. Trust, Jean F. Cochrane and Jordan H. Stout

December 1997

**Ecological Services Anchorage Field Office
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**Fish and Wildlife Service
US Department of the Interior**

**USFWS Technical Report
WAES-TR-97-03**

↖ EXECUTIVE SUMMARY ↘

This study provides baseline data on contaminant concentrations in three eider species from coastal areas of western and northern Alaska and arctic Russia. Substantial declines in Alaskan-breeding populations of the spectacled (*Somateria fischeri*) and Steller's eiders (*Polypticla stelleri*), have gone largely unexplained and have raised concerns about contaminant exposures on breeding grounds and in the Bering Sea and Arctic Ocean. Of the 78 eider carcasses we acquired, 51 were common eiders (*Somateria mollissima*), 18 were spectacled eiders and 7 were Steller's eiders.

Given that many arctic and subarctic marine organisms have been found with notable concentrations of organochlorines in their tissues, we were surprised to find minimal concentrations in these eiders from Alaska and arctic Russia. As for the elemental residues, aluminum, barium, beryllium, boron, iron, magnesium, manganese, molybdenum, nickel, strontium, vanadium and zinc residues were found at levels that were biologically essential or were far below concentrations believed to cause harmful effects in birds and thus are not discussed. The remaining analytes (arsenic, cadmium, chromium, copper, lead, mercury and selenium) are discussed either because they are known to be toxic at relatively low concentrations or because they were found at concentrations warranting further review.

The data suggest that cadmium was elevated in some spectacled eiders, copper was elevated in common and spectacled eiders, lead was elevated in a few eiders believed to have ingested lead shot and selenium was highly elevated in spectacled eiders. It is not clear, however, why concentrations were elevated in these birds or how widespread the contamination is in their populations. Furthermore, we do not know whether these elevated concentrations represent an increase in risk to eider populations. Results from this report, however, will help to focus future studies involving contaminants and routes of exposure.

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INTRODUCTION

This study provides baseline data on contaminant concentrations in three eider species from coastal areas of western and northern Alaska and arctic Russia. When we began accumulating the data in 1991, no information was available on environmental contaminants in North Pacific eider ducks. Substantial declines in Alaskan-breeding populations of the spectacled eiders (*Somateria fischeri*) and Steller's eiders (*Polysticta stelleri*) have gone largely unexplained, raising concerns about contaminant exposures on the breeding grounds and in the Bering Sea and Arctic Ocean. Data for the spectacled and Steller's eiders, now listed as threatened species under the Endangered Species Act of 1973 as amended, were obtained largely through incidental carcass collections. While such carcass data may not be random, it has provided relatively low-cost, low-impact data on these threatened species. Much of the data collected on the common eiders (*Somateria mollissima*), however, was obtained through a more systematic sampling of birds in the Aleutian Island Archipelago. Using these data, our objective was to report the elemental and organochlorine contaminants found in these three sea duck species.

Some of the data covered in this report have been described elsewhere. Henny et al. (1995) included our analytical results from three spectacled eiders taken by hunters on Saint Lawrence Island in 1991. We did not realize these data would be published and did not review the manuscript for accuracy. Franson et al. (1995) described lead poisoning in four spectacled eiders and one common eider from the Yukon-Kuskokwim (YK) Delta between 1992 and 1994. We present additional elemental and organochlorine results from these birds.

Elements

Sea ducks are known to accumulate high concentrations of nonessential metals such as cadmium (Di Giulio and Scanlon, 1984). Nutrient elements, however, are usually not notably higher in sea ducks than in other ducks residing in the same areas (Ohlendorf et al., 1986). Cadmium and mercury levels were elevated in various marine species in the North Pacific (Ohlendorf, 1993), but it is not known whether this was due to recent anthropogenic sources or if these elements were harmful at the recorded concentrations. Selenium is another element of concern for waterfowl and lead poisoning from ingesting spent lead shot has killed eiders on the YK Delta, Alaska (Franson et al., 1995). Cadmium, lead and selenium have synergistic effects and their toxicity can also be influenced by body concentrations of zinc and copper, hence levels of these elements should be considered in concert.

Organochlorines

Organochlorine pesticides and polychlorinated biphenyls (PCBs) have been found in measurable concentrations in polar ice caps (Gregor et al., 1995) and tissues from high latitude animals such as invertebrates (Bright et al., 1995a; Bright et al., 1995b), fish (Bright et al., 1995a; Bright et al., 1995b; Wilson et al., 1995), marine mammals (Galster and Burns, 1972; Taylor et al., 1989; Giger and Trust, 1997; Estes et al., 1997) and birds (Szaro et al., 1979; Scharf, 1995; Barrett et

al., 1996; Stout and Trust, In Prep.). Due to the remoteness of the habitats from which these animals came, these studies suggest that several of the compounds may be undergoing long-range atmospheric or oceanic transport. Furthermore, there is evidence that such compounds are accumulating at the polar regions of the globe, though this trend may now be declining (Barrett et al., 1996). Thus, it may be reasonable to expect detectable concentrations of man-made chemicals in the tissues of animals from seemingly pristine environments.

MATERIALS AND METHODS

Carcass Collection

Beginning in late 1991, we notified natural resource agencies and the general public within spectacled and Steller's eider ranges about our interest in acquiring eider carcasses. Agencies included the US Fish and Wildlife Service (Service), the Alaska Department of Fish and Game, the US Geological Survey-Biological Resources Division and the North Slope Borough. To solicit public involvement, we included our request for carcasses in public service announcements, brochures, posters and informal communications related to the Endangered Species Act listing and recovery planning effort for the spectacled eider.

The common eiders collected from the Aleutian Islands were part of a Service study by the Migratory Bird Management Division and liver and kidney tissues from the spectacled and Steller's eiders of the Indigirka River Delta were donated by Russian biologists (Figure 1). The remainder of the carcasses were obtained by opportunistic carcass recoveries by agency field personnel and other cooperators. Of the 78 eider carcasses we acquired, 51 were common eiders, 18 were spectacled eiders and 7 were Steller's eiders (Table 1 and Appendix A).

Sample Collection

At Alaskan field sites, whole carcasses were tagged, wrapped in plastic bags and frozen as soon as possible; though some birds were held for up to a few days under cool field conditions before freezing. Frozen carcasses were then shipped to Anchorage, Alaska. The Indigirka River Delta carcasses were dissected in Russia, where tissue samples were removed and placed into chemically clean I-CHEM® 300-series glass jars (I-CHEM, Hayward, CA) before freezing and shipment to Anchorage.

Carcasses were thawed, measured and weighed before dissection. Acid/acetone-washed dissection tools and sterile carbon-steel scalpel blades were used to remove liver and kidney samples from each bird. Tissues were placed into I-CHEM® jars and frozen immediately. Frozen samples were then shipped to contract laboratories for analysis as described below.

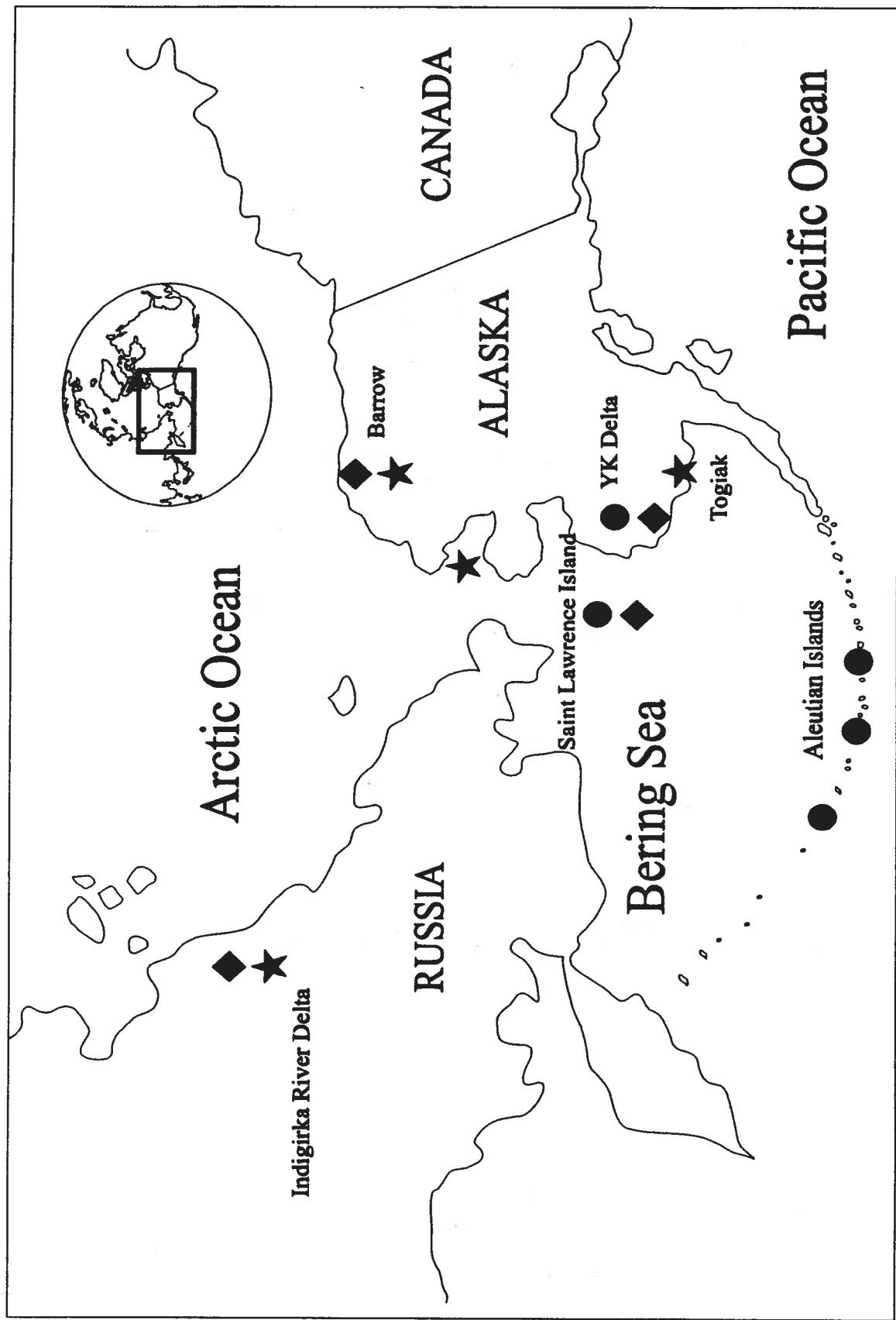


Figure 1: Elder carcass recovery locations in Alaska and arctic Russia. Species collected are indicated as common eider (●), spectacled eider (◆) and Steller's eider (★). See Appendix A for more complete information.

Table 1: Summary of eider carcasses acquired from Alaska and Russia for contaminants analysis, 1991-1995.

Species / Location	Years	Number by Age/Sex					Elements		Organics	
		AF	AM	JF	JM	Total	Kidney	Liver	Kidney	Liver
common eiders:										
YDNWR	92, 93, 95	3				3	3	3		
Saint Lawrence Island	94	1				1	1	1		
Aleutians: Adak	93		1			1	1	1	1	1
Agattu	93	5	5		1	11	11	11	11	11
Alaid/Nizki	93	5	20			25	25	25	25	25
Amchitka	93	7	1	1		9	9	9	9	9
Attu	93		2			2	2	2	2	2
spectacled eiders:										
YDNWR	92, 93, 94	4	3	1		8	8	8		
YDNWR: Kigigak Island	94	2				2	2	2		
Saint Lawrence Island	91, 94	1	2		1	4	4	4		
Barrow	93			1		1	1	1		
Indigirka Delta, Russia	95	1	2			3	3	3		3
Steller's eiders:										
Togiak NWR	91, 92	2				2	2	2		
Barrow	93	1	2			3	3	3	3	
Indigirka Delta, Russia	94	1	1			2	2	2	2	
Bering Sea	94	1				1	1	1	2	2

YDNWR = Yukon Delta National Wildlife Refuge

NWR = National Wildlife Refuge

AF = Adult female

AM = Adult male

JF = Juvenile female

JM = Juvenile male

Analytical Methods

Elemental Analysis

Eider tissues from 1991 underwent elemental analysis at the Research Triangle Institute (Research Triangle Park, North Carolina), whereas those from 1992, 1994 and 1995 went to Hazelton Laboratories America, Inc. (Madison, Wisconsin) for analysis. Of the 48 eiders from 1993, 44 underwent elemental analysis at Environmental Trace Substances Research Center, University of Missouri (Columbia, Missouri) and the remaining four went to the Patuxent Analytical Control Facility (PACF), Patuxent Wildlife Research Center (Laurel, Maryland) for analysis.

Aluminum (Al), barium (Ba), beryllium (Be), boron (B), cadmium (Cd), chromium (Cr), copper (Cu), iron (Fe), lead (Pb), magnesium (Mg), manganese (Mn), molybdenum (Mo), nickel (Ni), strontium (Sr), vanadium (V) and zinc (Zn) were analyzed by inductively coupled plasma emission spectroscopy. Arsenic (As) and selenium (Se) were analyzed by graphite furnace atomic absorption spectrometry and mercury (Hg) was analyzed by cold vapor atomic absorption.

Organochlorine Analysis

Livers and kidneys from 37 common eiders and livers from three Steller's eiders collected in 1993 underwent organochlorine analysis at the Mississippi State Chemical Laboratories (Mississippi State, Mississippi), whereas livers and kidneys from two Steller's eiders collected in 1994 and livers from three spectacled eiders collected in 1995 went to Hazelton Laboratories America, Inc. for analysis. The remaining eider tissues did not undergo organochlorine analysis. PCB analysis included either total PCBs or congener-specific analysis involving PCB-1242, 1248, 1254 and 1260.

Quality Assurance / Quality Control (QA/QC)

Accuracy and precision were assessed through spiked sample recoveries and duplicate analyses for 10% of the tissue samples. Contamination of analytical equipment was assessed through the use of procedural blanks for each analyte. Data that did not meet the criteria set forth by Quakenbush and Snyder-Conn (1993) and K. Mueller (personal communication) are noted in Appendices B-E. The criteria were as follows:

1. Accuracy was found to be acceptable if the spiked sample recoveries were between 80 and 120%.
2. Precision, as measured by comparison of duplicates, was found to be acceptable if the relative percent difference (RPD) was less than or equal to 20%. RPD was calculated by the following equation:

$$RPD = \frac{(D_1 - D_2)}{(D_1 + D_2) / 2} * 100$$

Where:

D_1 = concentration measured in the first analysis

D_2 = concentration measured in the second analysis

3. Procedural blanks were found to be acceptable if the blank concentration was less than 15% of the mean sample concentration (MSC), provided that the MSC was greater than the limit of detection.

For most elements, spike recoveries were between 80 and 120% of known values, duplicates were within 20% of reference values and blanks were \leq 15% of the MSC. Exceptions for elements are noted in Appendices B and C, and those samples are not included in Table 2. Detection limits for the tissues analyzed at PACF were an order of magnitude higher than those analyzed at the other laboratories. Though only 5% of the tissues sampled were analyzed at PACF, all of them were from common eiders. It is therefore possible that the common eider median values reported herein are less reliable for some elements.

Most liver organochlorine concentrations (>95%) were found to be below detection limits and therefore unable to meet the QA/QC criteria (Appendices D and E). However, those samples meeting the QA/QC criteria are discussed in the Organochlorines Residues Section below.

Data Presentation

All analytical results are expressed in parts per million (ppm) on a dry-weight basis. Where necessary for discussion, we converted wet-weight concentrations from the literature to dry-weight values using moisture contents supplied by authors or by assuming an average tissue moisture content of 70%. Converted concentrations are noted as such.

Though median elemental concentrations and ranges based on detected values in livers and kidneys of each species were determined (Tables 3 and 4), no further statistical analyses are performed. Analytical results for the residues in individual tissues are presented in Appendices B-E and qualitative comparisons are outlined for specific residues in the Results & Discussion Section below.

RESULTS & DISCUSSION

Elemental Residues

All of the elemental data are reported in Appendices B and C. For those elemental residues in which fewer than 50% of the samples were above the detection limit, only ranges were determined (Table 2). For those residues detected in at least 50% of the samples, median concentrations and ranges were determined (Tables 3 and 4). When calculating medians, values found to be below detection were substituted with one half the detection limit. When determining ranges, only detected values were used.

The aluminum, barium, beryllium, boron, iron, magnesium, manganese, molybdenum, nickel, strontium, vanadium and zinc residues were found at levels that were either biologically essential or far below concentrations believed to cause harmful effects in birds. For this reason the concentrations of these analytes are shown in the applicable tables (2, 3 and 4) and appendices (B and C), but are not discussed below. The remaining analytes (arsenic, cadmium, chromium, copper, lead, mercury and selenium) are discussed below either because they are known to be toxic at relatively low concentrations or because they were found at concentrations warranting further review.

Table 2: Concentration ranges of elemental residues for which fewer than 50% of the samples were above detection. Values are given in parts per million (ppm) dry weight concentrations. Sample size given as the number of samples having detectable concentrations.

Element:	Tissue Type:	Range:	Sample Size:
common eiders (n=51):			
Aluminum	Liver	4.00 - 9.00	8
Barium	Liver	ABD*	0
Beryllium	Liver	0.100	1
Boron	Liver	1.33 - 5.00	20
Chromium	Liver	0.10 - 2.50	14
Nickel	Liver	0.10 - 1.83	4
Lead	Liver	0.70 - 187.23	14
Vanadium	Liver	0.30 - 11.63	6
Aluminum	Kidney	3.00 - 23.00	7
Beryllium	Kidney	0.10 - 0.30	9
Nickel	Kidney	0.10 - 1.00	11
Lead	Kidney	0.50 - 91.63	2
Vanadium	Kidney	0.30 - 1.21	15
spectacled eiders (n=18):			
Aluminum	Liver	4.72 - 16.00	4
Barium	Liver	0.31	1
Beryllium	Liver	ABD	0
Nickel	Liver	0.36 - 6.39	8
Lead	Liver	0.50 - 174.88	8
Vanadium	Liver	0.50 - 2.98	8
Aluminum	Kidney	6.01 - 16.30	5
Barium	Kidney	0.10 - 1.20	3
Beryllium	Kidney	0.16	1
Nickel	Kidney	0.19 - 10.74	9
Steller's eiders (n=7):			
Aluminum	Liver	ABD	0
Barium	Liver	0.20 - 0.61	2
Beryllium	Liver	ABD	0
Boron	Liver	2.63 - 130.07	2
Lead	Liver	1.70 - 26.00	2
Aluminum	Kidney	4.47	1
Barium	Kidney	0.10 - 1.60	3
Beryllium	Kidney	ABD	0
Lead	Kidney	2.66 - 93.00	2
Vanadium	Kidney	0.30 - 1.09	3

* ABD = All samples were found to be below the detection limit

Table 3: Median concentrations of elements in eider livers for which more than 50% of samples were above detectable limits. Values are reported in parts per million (ppm), dry-weight concentrations. Ranges of detected values are shown in parentheses.

Element:	common (n=51)	spectacled (n=18)	Steller's (n=7)	Overall (N=76)
Arsenic	0.30 (0.05 - 1.40)	0.39 (0.03 - 1.01)	0.45 (0.05 - 2.61)	0.30 (0.03 - 2.61)
Boron	BD*	2.39 (0.49 - 15.84)	BD	BD
Cadmium	19.15 (4.29 - 40.90)	50.51 (0.11 - 179.23)	8.15 (1.24 - 17.72)	20.70 (0.11 - 179.23)
Chromium	BD	0.50 (0.10 - 5.43)	0.50 (0.39 - 1.86)	BD
Copper	403.00 (14.00 - 1,770.00)	771.50 (11.60 - 3,695.65)	38.18 (21.00 - 77.99)	381.16 (11.60 - 3,695.65)
Iron	1,070.00 (266.00 - 4,710.00)	2,325.00 (663.00 - 10,620.44)	2,738.83 (1,120.00 - 5,984.56)	1,280.00 (266.00 - 10,620.44)
Magnesium	702.94 (552.00 - 862.00)	690.07 (485.89 - 801.00)	728.52 (589.09 - 818.53)	701.00 (485.89 - 862.00)
Manganese	15.00 (9.50 - 32.66)	15.09 (10.00 - 26.97)	17.00 (9.31 - 32.47)	15.00 (9.31 - 32.47)
Mercury	1.70 (0.56 - 5.00)	1.38 (0.36 - 5.67)	2.68 (2.12 - 7.61)	1.70 (0.36 - 7.61)
Molybdenum	3.90 (0.50 - 8.50)	3.72 (0.50 - 9.90)	3.00 (2.00 - 4.40)	3.71 (0.50 - 9.90)
Nickel	BD	BD	1.10 (0.63 - 1.68)	BD
Selenium	8.40 (2.50 - 43.97)	77.30 (4.98 - 400.48)	21.85 (8.18 - 56.76)	10.60 (2.50 - 400.48)
Strontium	0.80 (0.30 - 30.40)	0.70 (0.23 - 4.50)	0.24 (0.10 - 9.31)	0.76 (0.10 - 30.40)
Vanadium	BD	BD	0.55 (0.51 - 1.60)	BD
Zinc	125.00 (78.80 - 414.89)	145.45 (92.53 - 608.70)	119.00 (101.03 - 153.67)	127.50 (78.80 - 608.70)

* BD = Residues for which at least 50% of the samples were below the detection limit (see table 2)

Table 4: Median concentrations of elements in eider kidneys for which more than 50% of samples were above detectable limits. Values are reported in parts per million (ppm), dry-weight concentrations. Ranges of detected values are shown in parentheses.

Element:	common (n=51)	spectacled (n=18)	Steller's (n=7)	Overall (N=76)
Arsenic	0.33 (0.05 - 4.20)	0.39 (0.05 - 2.34)	0.34 (0.05 - 2.05)	0.35 (0.05 - 4.20)
Barium	0.10 (0.10 - 0.20)	BD*	BD	BD
Boron	4.00 (2.00 - 8.30)	3.66 (2.82 - 43.70)	6.10 (1.85 - 9.38)	4.00 (1.85 - 43.70)
Cadmium	100.20 (10.20 - 189.15)	136.82 (0.15 - 353.27)	33.30 (1.96 - 50.22)	94.13 (0.15 - 353.27)
Chromium	0.14 (0.10 - 1.18)	0.76 (0.14 - 7.48)	0.88 (0.23 - 2.24)	0.22 (0.10 - 7.48)
Copper	42.50 (20.00 - 117.87)	77.19 (14.40 - 200.55)	25.07 (8.25 - 50.00)	43.90 (8.25 - 200.55)
Iron	597.00 (236.00 - 1,566.50)	902.00 (483.00 - 1,275.28)	517.00 (270.00 - 947.12)	624.79 (236.00 - 1,566.50)
Lead	BD	27.65 (0.50 - 130.00)	BD	BD
Magnesium	818.00 (87.00 - 1,070.00)	721.83 (431.00 - 1,102.80)	788.00 (185.00 - 1,514.42)	790.50 (87.00 - 1,514.42)
Manganese	10.00 (3.70 - 14.00)	9.33 (4.15 - 14.29)	13.00 (6.60 - 17.02)	10.00 (3.70 - 17.02)
Mercury	0.82 (0.33 - 3.10)	0.70 (0.04 - 1.87)	1.42 (0.50 - 2.50)	0.82 (0.04 - 3.10)
Molybdenum	2.00 (0.50 - 3.46)	2.35 (0.90 - 4.94)	2.00 (0.40 - 3.81)	2.00 (0.40 - 4.94)
Nickel	BD	BD	0.77 (0.19 - 2.05)	BD
Selenium	6.40 (4.00 - 57.14)	39.15 (5.35 - 234.29)	12.05 (4.62 - 18.18)	7.10 (4.00 - 234.29)
Strontium	2.07 (0.55 - 16.10)	1.59 (0.42 - 9.81)	0.57 (0.13 - 28.61)	1.72 (0.13 - 28.61)

Table 4 (continued):

Element:	common (n=51)	spectacled (n=18)	Steller's (n=7)	Overall (N=76)
Vanadium	BD	0.58 (0.25 - 0.77)	BD	BD
Zinc	132.00 (92.40 - 210.34)	148.87 (62.10 - 300.56)	115.00 (29.30 - 137.00)	133.00 (29.30 - 300.56)

* BD = Residues for which at least 50% of the samples were below the detection limit (see table 2)

Arsenic

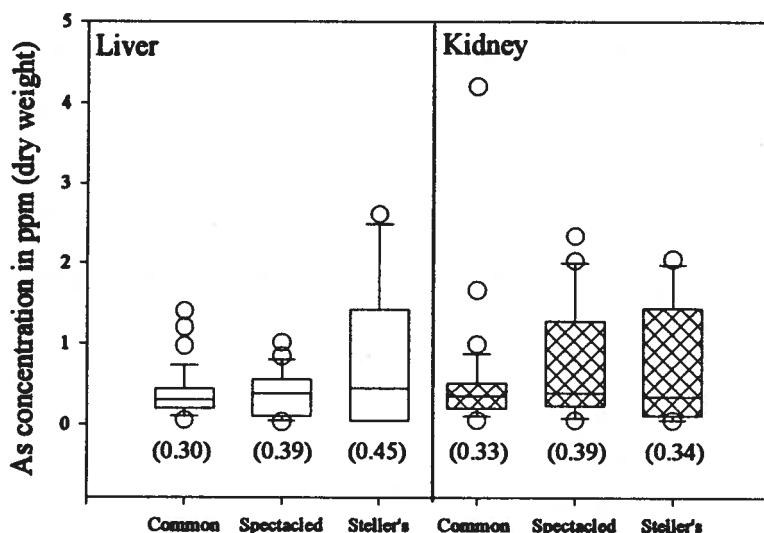


Figure 2: Arsenic concentrations in eider tissues from Alaska and arctic Russia. Median values are shown in parentheses.

Arsenic is a common element that is nutritionally essential at very low concentrations, but teratogenic and carcinogenic at higher concentrations (Ohlendorf, 1993). Eisler (1988a) suggested that arsenic concentrations in avian tissues are usually greater than about 3 ppm* and that concentrations in excess of 7 to 33 ppm* should be considered elevated.

Overall, median arsenic concentrations in the eider liver (0.30 ppm) and kidney (0.35 ppm) tissues were similar. Arsenic concentrations ranged from below detection in all sample groups to 1.40

* Converted from fresh weights

ppm in livers and 4.20 ppm in kidneys for common eiders, 1.01 ppm in livers and 2.34 ppm in kidneys for spectacled eiders, and 2.61 ppm in livers and 2.05 ppm in kidneys for Steller's eiders (Figure 2). The highest liver concentration was found in a Steller's eider from the Bering Sea (2.61 ppm), whereas the highest kidney concentration was found in a common eider from the Aleutian Islands (4.20 ppm).

Cadmium

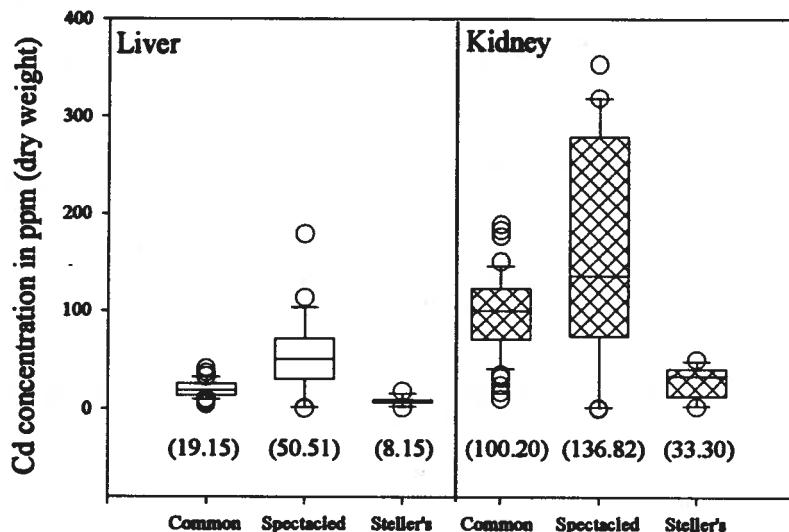


Figure 3: Cadmium concentrations in eider tissues from Alaska and arctic Russia.
Median values are shown in parentheses.

Cadmium is a relatively rare heavy metal with no known biological value. It is teratogenic, carcinogenic and probably mutagenic (Eisler, 1985a). Anthropogenic sources include smelting, coal and oil burning, fertilizers, waste incineration and wastewaters; hence, concentrations are highest near industrial sources. Marine organisms are known to assimilate cadmium from the water column and thus generally contain substantially higher residues than their freshwater counterparts. Sublethal effects in birds include growth retardation, suppressed egg production, egg shell thinning, altered behavioral responses and others (Scheuhammer, 1987; Furness, 1996). Elevated cadmium residues affect the metabolism and concentration of iron, zinc and copper in bird tissues (Furness, 1996). Zinc, iron, calcium and selenium ameliorate cadmium's effects, whereas lead and mercury exacerbate them (Eisler, 1985a).

Eisler (1985a) suggested that cadmium concentrations in vertebrate livers and kidneys in excess of about 33 ppm be considered elevated and that kidney concentrations in excess of 667 ppm be considered life threatening, whereas Furness (1996) stated that liver and kidney concentrations in excess of about 133 and 333 ppm, respectively, are problematic, and that liver concentrations in seabirds are often between 17 and 117 ppm*.

Median tissue residues were lower in livers than in kidneys and higher in spectacled eiders than in either of the other two species collected (Figure 3). The median liver concentration in spectacled eiders was 50.51 ppm, compared with 19.15 ppm in common eiders and 8.15 ppm in Steller's eiders. Nine out of 18 spectacled eider livers contained cadmium concentrations in excess of 50 ppm, whereas none of the samples from the other species exceeded 41 ppm. The median kidney concentration in spectacled eiders was 136.82 ppm as compared with 100.20 ppm in common eiders and 33.30 ppm in Steller's eiders. Seven out of 18 spectacled eider kidneys contained cadmium concentrations in excess of 200 ppm, whereas none of the samples from the other species exceeded 190 ppm. All seven of the spectacled eiders were collected from either the Indigirka or YK River Deltas, and the median liver cadmium levels from all eiders collected from these habitats were at least twice that of the median concentrations found at other collection locations.

The liver cadmium concentrations found in our spectacled eiders were more than twice those found in common eiders from Norway (Lande, 1977; Norheim, 1987) and Denmark (Karlog, 1983). Our values were similar to those found in white-winged scoters during a die-off of unknown causes in Southeast Alaska (Henny et al., 1995) and less than the effect level found in dosed mallards (*Anas platyrhynchos*) (White et al., 1978). The concentrations found in our other eider species were less than those found in European common eiders (Lande, 1977; Karlog, 1983; Norheim, 1987), with the exception of our common eider kidneys. Residues were also less than or similar to those found in presumably healthy Steller's eiders from Barrow and the Togiak National Wildlife Refuge (Quakenbush and Snyder-Conn, 1993) and in oldsquaw (*Clangula hyemalis*), herring gulls (*Larus argentatus*), Arctic terns (*Sterna paradisaea*), and long-tailed jaegers (*Stercorarius longicaudus*) from northeastern Siberia (Kim et al., 1996).

* Converted from fresh weights

Chromium

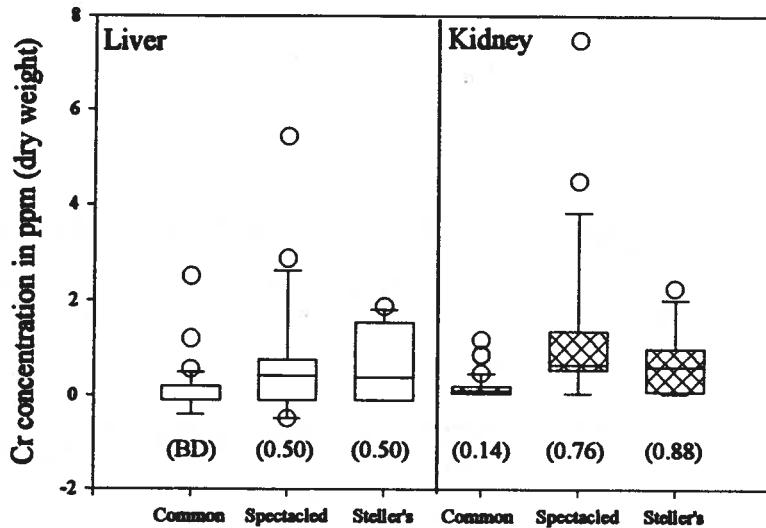


Figure 4: Chromium concentrations in eider tissues from Alaska and arctic Russia. Median values are shown in parentheses.

Chromium is an essential element for many animals, although it can be mutagenic at high concentrations. Data relating tissue concentrations with toxic effects are minimal; though Eisler (1986) suggested that concentrations greater than about 4 ppm on a dry weight basis are indicative of contamination.

We found median liver concentrations to be slightly less than median kidney concentrations and both were below 1.0 ppm (Figure 4). The highest chromium concentration in liver and kidney tissues was found in spectacled eiders from Saint Lawrence Island (5.43 ppm) and the YK Delta (7.48 ppm), respectively.

Liver chromium concentrations in these eiders were similar to those of greater scaup (*Aythya marila*) (Ohlendorf et al., 1986), surf scoters (*Melanitta perspicillata*) (Ohlendorf, 1987; Henny et al., 1991) and common eiders (Lande (1977).

Copper

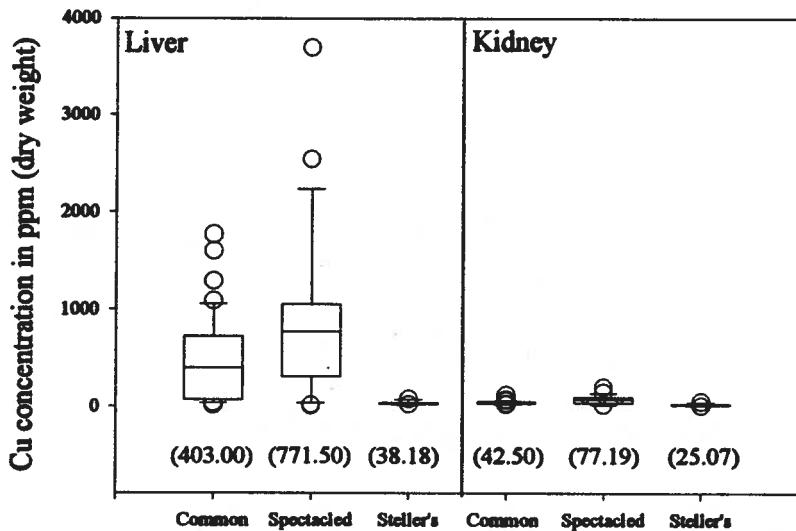


Figure 5: Copper concentrations in eider tissues from Alaska and arctic Russia. Median values are shown in parentheses.

Copper is an essential trace element that is regulated metabolically by organisms (Ohlendorf, 1993) and is known to exacerbate the toxic effects of lead (Eisler, 1988b). Toxicity reference values and information for sea ducks, however, are scarce.

Of the 51 common eiders in our study, 21 had liver concentrations in excess of 500 ppm and 5 had concentrations in excess of 1,000 ppm. Furthermore, of the 18 spectacled eiders, 10 had liver concentrations in excess of 500 ppm and 5 had concentrations in excess of 1,000 ppm. Overall, concentrations in eider livers varied greatly from 11.60 to 3,695.65 ppm with Steller's eiders showing the lowest median concentration of 38.18 ppm, followed by common eiders (403.00 ppm) and spectacled eiders (771.50 ppm) (Figure 5). The same trend of concentrations was seen with kidney (Steller's < common < spectacled eider), but to a lesser extent. The median kidney concentration found in Steller's eider (25.07 ppm) was about half that of the common eiders (42.50 ppm) and one third that of the spectacled eiders (77.19 ppm).

Median liver and kidney concentrations (381.16 and 43.90 ppm) in our eiders were higher than those in Steller's eiders reported by Quakenbush and Snyder-Conn (1993), but less than or similar to those in common eiders from Spitsbergen, Norway (900 ppm and 43 ppm) (Norheim, 1987) and similar to those found in a king eider (*Somateria spectabilis*) from northeastern Siberia (Kim et al., 1996). Norheim (1987) found that copper residues in eider livers were the highest of ten

seabird species analyzed, but suggested that such levels were not harmful based on comparisons with other waterfowl. This suggestion was later supported by histological examinations by Norheim and Borch-Johnsen (1990) who found no liver damage in an eider with high copper concentrations (3,500 ppm). With this in mind, it is conceivable that even the highest copper concentrations we found in spectacled eiders were not exceeding a toxic threshold, but verification of this conclusion is recommended.

Interestingly, male eiders had higher median liver residues (692.50 ppm) than did females (82.35 ppm) and liver residues from Barrow were an order of magnitude lower than those collected from the other locations.

Lead

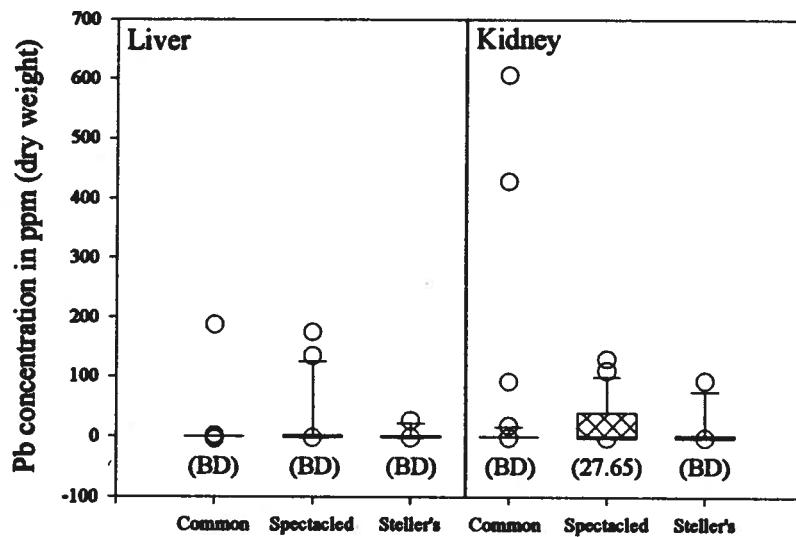


Figure 6: Lead concentrations in eider tissues from Alaska and arctic Russia. Median values are shown in parentheses.

Lead is a non-essential, toxic element; it does not biomagnify in food chains, but does bioaccumulate (Eisler, 1988b). The toxic effects of lead are exacerbated by excess body concentrations of cadmium, zinc, copper, and mercury (Eisler, 1988b). At sublethal concentrations, lead may reduce hatching and growth rates and cause behavioral abnormalities (Eisler, 1988b). Exposure to toxic levels of lead is often attributed to the ingestion of spent lead gunshot (Pain, 1996). Five eiders from the YK Delta died of lead poisoning from ingested shot (Franson et al., 1995) and contained liver residues of 187.23 ppm, 76.49 ppm, 135.00 ppm,

174.88 ppm and 102.09 ppm and kidney residues of 91.63 ppm, 39.09 ppm, 130.00 ppm, 110.11 ppm and 73.40 ppm, respectively.

Even though Scheuhammer (1987) concluded that kidney residues were a good indicator of recent lead exposure in birds, Di Giulio and Scanlon (1984) found that they were more variable in waterfowl than were liver concentrations. This reduced variability suggests that liver residues, which are more commonly reported in eiders, are more reliable for waterfowl in general. Pain (1996) suggested that waterfowl livers from uncontaminated environments generally have lead concentrations below about 7 ppm* and often below about 3 ppm*, whereas various studies have indicated that lead-poisoned waterfowl have mean liver concentrations between 40 and 213 ppm* (Longcore et al., 1974; Anderson, 1975; Clausen and Wolstrup, 1979).

In our study, lead was near or below the detection limits in all eider livers except one Steller's eider from Barrow (26.00 ppm) and the eiders reported by Franson et al. (1995). The Steller's eider was found dead of undetermined causes and had a kidney residue of 93.00 ppm, suggesting that lead poisoning may have contributed to its death. Three common eiders and one spectacled eider were found to have kidney residues (43.60 ppm, 428.00 ppm, 606.00 ppm and 39.20 ppm) which were similar to or higher than those reported by Franson et al. (1995). Of these, the three common eiders were taken by shotgun in the Aleutian Islands and found to have liver lead concentrations below the detectable limits (<0.20 ppm), and the spectacled eider was found dead in the YK Delta with a liver lead concentration of 0.5 ppm. These high concentrations found only in the kidney tissues suggest direct contamination by lead shot rather than contamination by the ingestion of lead by the birds prior to collection.

Female eider livers had higher median lead concentrations (39.10 ppm) than did male eider livers (1.17 ppm), and male kidneys had higher median lead concentrations (16.55 ppm) than did female eider kidney tissue (5.21 ppm). Furthermore, median tissue concentrations were an order of magnitude higher in eiders collected from the YK Delta and Barrow than in eiders collected from the other locations.

* Converted from fresh weights

Mercury

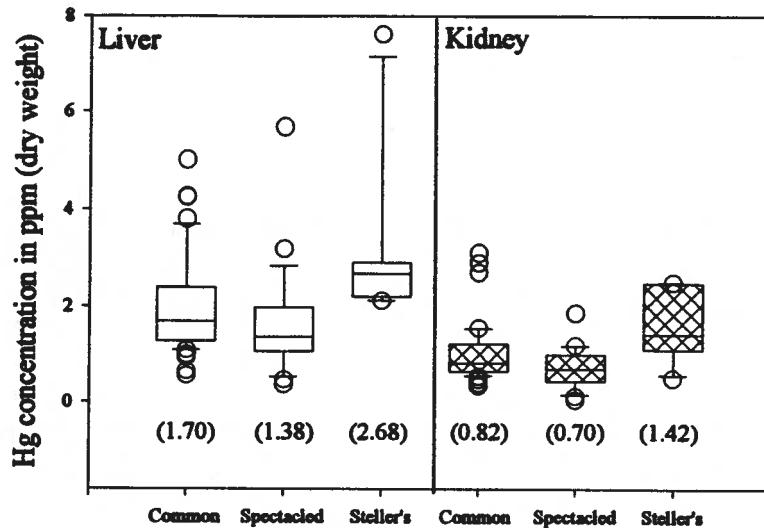


Figure 7: Mercury concentrations in eider tissues from Alaska and arctic Russia. Median values are shown in parentheses.

Mercury is a non-essential element that is toxic to most birds and rapidly biomagnified in food webs (Eisler, 1987). Normal physiological levels of mercury in waterfowl livers appear to be less than about 15 ppm* (Eisler, 1987) although in general, seabirds exhibit higher mercury concentrations than terrestrial birds (Thompson, 1996).

Concentrations in Steller's eiders for both tissues were 50-100% higher than those of the other two species and median concentrations in liver tissues (1.70 ppm) were higher than those of kidney tissues (0.82 ppm) (Figure 7). The highest liver concentration was found in a Steller's eider from the Indigirka Delta (7.61 ppm), whereas the highest kidney concentration was found in a common eider from the Aleutian islands (3.10 ppm).

The liver concentrations are less than those found in common eiders from Norway (mean: 3.3 ppm; range: 1.7 - 5.7 ppm) as reported by Norheim (1987), and concentrations in both tissues are less than those found in greater scaup (Ohlendorf et al., 1986), surf scoters (Ohlendorf et al., 1986; Ohlendorf, 1987; Henny et al., 1991) and from eleven species of seabirds from northeastern Siberia (Kim et al., 1996).

* Converted from fresh weights

Selenium

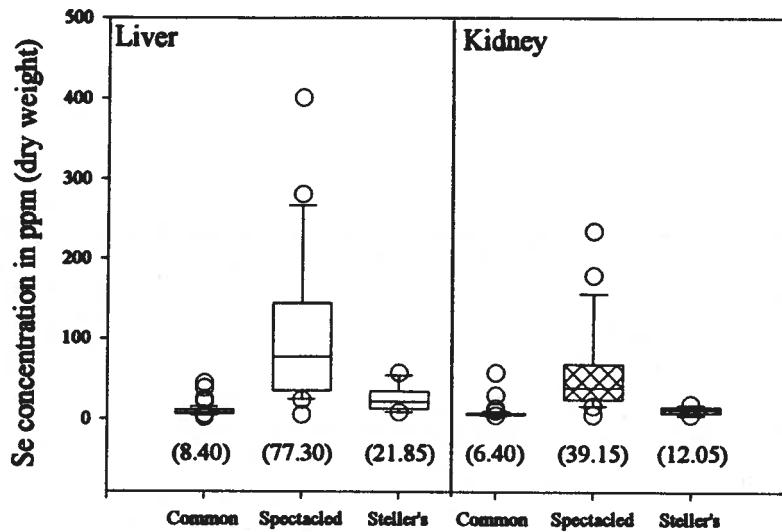


Figure 8: Selenium concentrations in eider tissues from Alaska and arctic Russia. Median values are shown in parentheses.

Selenium is a required micronutrient whose metabolism is significantly modified by interactions with various heavy metals and dietary proteins (Eisler, 1985b; Hoffman et al., 1992). At normal concentrations, it can reduce the toxic effects of cadmium, copper, lead, and mercury (Heinz, 1996), although it is known to bioaccumulate and can be toxic at high concentrations (Eisler, 1985b). High concentrations of selenium result from exposure to naturally seleniferous rocks and soils and from human activities such as the burning of fossil fuels and the smelting of various ores. Selenium concentrations are higher in marine birds than other bird species (Ohlendorf et al., 1986), although specific chemical forms of selenium in marine foods have not been reported (Heinz, 1996).

Toxicity in birds depends greatly on the chemical forms of selenium (Heinz et al., 1989; Hoffman and Heinz, 1988), thus total selenium, such as reported here, is not necessarily indicative of toxicity. Heinz (1996), however, states that avian liver concentrations in excess of about 10 ppm* may cause reproductive effects, concentrations in excess of about 33 ppm* may be toxic, and concentrations in excess of about 67 ppm* may be lethal. Furthermore, Moksnes (1983) and Ohlendorf et al. (1988) found the ratio of liver and kidney selenium concentrations in chickens and mallards to be near 1:1.

* Converted from fresh weights

In our study, median liver selenium concentrations were an order of magnitude higher in the eiders collected from the Indigirka River Delta than in eiders collected from the other locations. In addition, the median liver residue of spectacled eiders (77.30 ppm) was nearly three times that of the Steller's eiders (21.85 ppm) and nearly ten times higher than that of the common eiders (8.40 ppm). Of the 18 spectacled eiders, 7 had liver concentrations in excess of 100 ppm. Overall kidney residues (7.10 ppm) were less than those in liver (10.60 ppm), but followed a similar trend with spectacled eiders (39.15 ppm) being three times that of the Steller's eiders (12.05 ppm) and six times that of the common eiders (6.40 ppm).

Norheim (1987) reported mean selenium concentrations (and ranges) in the livers of common eiders to be about 30 (11.3 - 83) ppm*, whereas Hutton (1981) reported mean concentrations in livers and kidneys to be 12.8 ppm and 12.7 ppm in oystercatchers (*Haematopus ostralegus*), 7.9 and 14.1 ppm in herring gulls and 19.7 and 32.8 ppm in great skua (*Catharacta skua*). Median selenium concentrations found in the tissues of our common eiders were lower than those found in Steller's eiders reported by Quakenbush and Snyder-Conn (1993) and in greater scaup (Ohlendorf et al., 1986) and surf scoters (Ohlendorf et al., 1986; Ohlendorf, 1987; Henny et al., 1991). Concentrations in our Steller's eider tissues, however, were consistent with the aforementioned birds and concentrations in spectacled eiders were higher than residues found anywhere in the literature for sea ducks.

Organochlorine Residues

None of the organochlorines were found in any appreciable concentrations in either tissue or in any of the three species (Appendices D and E). Concentrations of alpha-, beta-, gamma- and delta-BHCs; alpha- and gamma-chlordanes; *cis*- and *trans*-nonachlors; endrin; mirex; o,p-DDD, DDE and DDT; p,p-DDD and DDT; and toxaphene were not detected in any of the tissues analyzed. The few measurable residues of HCB, PCBs (measured as either total or congener-specific), dieldrin, heptachlor epoxide, oxychlordane and p,p-DDE were detected in less than 50% of the samples. Furthermore, all of the measurable organochlorine quantities were found to be within an order of magnitude of the detection limit, which ranged from 0.03 to 1.24 ppm. Organochlorine data are only presented in Appendices D and E.

CONCLUSION

Most of the samples we analyzed resulted from opportunistic carcass recoveries rather than purely random or systematic sampling. Therefore, birds found dead may not be representative of the populations from which they came. Thus, we do not extrapolate from the residues found in these birds to the species or even the population level. However, given that both the spectacled and the Steller's eiders have suffered population declines in recent years and are currently listed as threatened species, even opportunistically-collected birds add to the limited contaminants knowledge now available.

* Converted from fresh weights

Given that many arctic and subarctic marine organisms have been found with notable concentrations of organochlorines in their tissues, we were surprised to find minimal concentrations in these eiders from Alaska and arctic Russia. Our data do not appear to support concerns regarding organochlorine exposures on breeding grounds and in the Bering Sea and Arctic Ocean.

As for the elemental residues, the data show that cadmium was elevated in some spectacled eiders, copper was elevated in common and spectacled eiders, lead was elevated in a few eiders believed to have ingested lead shot and selenium was highly elevated in spectacled eiders. It is not clear, however, why concentrations were elevated in these birds or how widespread the contamination is in their populations. Furthermore, we do not know whether these elevated concentrations represent an increase in risk to eider populations. Results from this report, however, will help to focus future studies involving contaminants and routes of exposure.

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Appendix A:

Carcass and tissue recovery information

common eider (*Somateria mollissima*)

Bird ID No.	Age ¹	Sex ²	Date Collected	Location ³	Latitude / Longitude	ECMDS ⁴	Tissue Type	Analysis ⁵	Moisture ⁶
92COHS1K	Adult	F	8-Jul-92	Hock Slough (YKD)	61N 18' 00" / 165W 36' 00"	7020013	Kidney	E	79.70%
92COHS1L	Adult	F	8-Jul-92	Hock Slough (YKD)	61N 18' 00" / 165W 36' 00"	7020013	Liver	E	71.80%
93COA10K	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 00" / 173E 54' 00"	7020014	Kidney	E/O	73.90%
93COA11K	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 00" / 173E 54' 00"	7020014	Kidney	E/O	73.50%
93COA12K	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 00" / 173E 54' 00"	7020014	Kidney	E/O	75.30%
93COA13K	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 00" / 173E 54' 00"	7020014	Kidney	E/O	74.20%
93COA14K	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 00" / 173E 54' 00"	7020014	Kidney	E/O	75.20%
93COA15K	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 00" / 173E 54' 00"	7020014	Kidney	E/O	74.90%
93COA16K	Adult	M	31-May-93	Attu Island	52N 50' 00" / 173E 14' 00"	7020014	Kidney	E/O	76.30%
93COA17K	Adult	M	31-May-93	Attu Island	52N 50' 00" / 173E 14' 00"	7020014	Kidney	E/O	76.10%
93COA18K	Sub-adult	M	2-Jun-93	Agattu Island	52N 26' 00" / 173E 36' 00"	7020014	Kidney	E/O	75.10%
93COA19K	Adult	M	2-Jun-93	Agattu Island	52N 26' 00" / 173E 36' 00"	7020014	Kidney	E/O	74.00%
93COA1K	Adult	M	26-May-93	Adak Island	51N 45' 00" / 176E 45' 00"	7020014	Kidney	E/O	72.50%
93COA20K	Adult	M	2-Jun-93	Agattu Island	52N 26' 00" / 173E 36' 00"	7020014	Kidney	E/O	74.60%
93COA21K	Adult	M	2-Jun-93	Agattu Island	52N 26' 00" / 173E 36' 00"	7020014	Kidney	E/O	74.80%
93COA22K	Adult	M	12-Jun-93	Amchitka Island	51N 32' 00" / 179E 00' 00"	7020014	Kidney	E/O	72.60%
93COA23K	Adult	F	4-Jun-93	Alaid / Nizki Islands	52N 45' 50" / 173E 54' 00"	7020014	Kidney	E/O	73.60%
93COA24K	Adult	F	4-Jun-93	Alaid / Nizki Islands	52N 45' 50" / 173E 54' 00"	7020014	Kidney	E/O	75.40%
93COA25K	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 50" / 173E 54' 00"	7020014	Kidney	E/O	74.60%
93COA26K	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 50" / 173E 54' 00"	7020014	Kidney	E/O	76.60%
93COA27K	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 50" / 173E 54' 00"	7020014	Kidney	E/O	75.70%
93COA28K	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 50" / 173E 54' 00"	7020014	Kidney	E/O	75.30%
93COA29K	Adult	M	2-Jun-93	Agattu Island	52N 26' 00" / 173E 36' 00"	7020014	Kidney	E/O	75.10%
93COA30K	Adult	M	2-Jun-93	Agattu Island	52N 26' 00" / 173E 36' 00"	7020014	Kidney	E/O	75.00%
93COA31K	Adult	F	2-Jun-93	Agattu Island	52N 26' 00" / 173E 36' 00"	7020014	Kidney	E/O	75.80%
93COA32K	Adult	F	2-Jun-93	Agattu Island	52N 26' 00" / 173E 36' 00"	7020014	Kidney	E/O	76.40%
93COA33K	Adult	F	2-Jun-93	Agattu Island	52N 26' 00" / 173E 36' 00"	7020014	Kidney	E/O	73.60%
93COA34K	Adult	F	2-Jun-93	Agattu Island	52N 26' 00" / 173E 36' 00"	7020014	Kidney	E/O	73.20%
93COA35K	Adult	F	2-Jun-93	Agattu Island	52N 26' 00" / 173E 36' 00"	7020014	Kidney	E/O	77.10%
93COA36K	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 50" / 173E 54' 00"	7020014	Kidney	E/O	84.00%
93COA37K	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 50" / 173E 54' 00"	7020014	Kidney	E/O	73.90%
93COA38K	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 50" / 173E 54' 00"	7020014	Kidney	E/O	75.80%

Appendix A (continued)

Bird ID No.:	Age:	Sex:	Date Collected:	Location:	Latitude / Longitude:	ECDMS	Tissue Type:	Analysis	Moisture:
93COA39K	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 50" / 173E 54' 00"	7020014	Kidney	E/O	76.50%
93COA40K	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 50" / 173E 54' 00"	7020014	Kidney	E/O	73.90%
93COA41K	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 50" / 173E 54' 00"	7020014	Kidney	E/O	77.20%
93COA6K	Adult	F	12-Jun-93	Amchitka Island	51N 32' 00" / 179E 00' 00"	7020014	Kidney	E/O	72.10%
93COA7K	Adult	F	4-Jun-93	Alaid / Nizki Islands	52N 45' 00" / 173E 54' 00"	7020014	Kidney	E/O	73.00%
93COA8K	Adult	F	4-Jun-93	Alaid / Nizki Islands	52N 45' 00" / 173E 54' 00"	7020014	Kidney	E/O	73.80%
93COA9K	Adult	F	4-Jun-93	Alaid / Nizki Islands	52N 45' 00" / 173E 54' 00"	7020014	Kidney	E/O	75.20%
93COA10L	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 00" / 173E 54' 00"	7020014	Liver	E/O	70.60%
93COA11L	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 00" / 173E 54' 00"	7020014	Liver	E/O	70.90%
93COA12L	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 00" / 173E 54' 00"	7020014	Liver	E/O	69.30%
93COA13L	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 00" / 173E 54' 00"	7020014	Liver	E/O	68.10%
93COA14L	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 00" / 173E 54' 00"	7020014	Liver	E/O	69.70%
93COA15L	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 00" / 173E 54' 00"	7020014	Liver	E/O	67.70%
93COA16L	Adult	M	31-May-93	Attu Island	52N 50' 00" / 173E 14' 00"	7020014	Liver	E/O	71.90%
93COA17L	Adult	M	31-May-93	Attu Island	52N 50' 00" / 173E 14' 00"	7020014	Liver	E/O	70.30%
93COA18L	Sub-adult	M	2-Jun-93	Agattu Island	52N 26' 00" / 173E 36' 00"	7020014	Liver	E/O	70.50%
93COA19L	Adult	M	2-Jun-93	Agattu Island	52N 26' 00" / 173E 36' 00"	7020014	Liver	E/O	69.20%
93COA1L	Adult	M	26-May-93	Adak Island	51N 45' 00" / 176E 45' 00"	7020014	Liver	E/O	70.30%
93COA20L	Adult	M	2-Jun-93	Agattu Island	52N 26' 00" / 173E 36' 00"	7020014	Liver	E/O	69.80%
93COA21L	Adult	M	2-Jun-93	Agattu Island	52N 26' 00" / 173E 36' 00"	7020014	Liver	E/O	69.50%
93COA22L	Adult	M	12-Jun-93	Amchitka Island	51N 32' 00" / 179E 00' 00"	7020014	Liver	E/O	65.90%
93COA23L	Adult	F	4-Jun-93	Alaid / Nizki Islands	52N 45' 50" / 173E 54' 00"	7020014	Liver	E/O	67.30%
93COA24L	Adult	F	4-Jun-93	Alaid / Nizki Islands	52N 45' 50" / 173E 54' 00"	7020014	Liver	E/O	67.80%
93COA25L	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 50" / 173E 54' 00"	7020014	Liver	E/O	68.10%
93COA26L	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 50" / 173E 54' 00"	7020014	Liver	E/O	69.00%
93COA27L	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 50" / 173E 54' 00"	7020014	Liver	E/O	68.70%
93COA28L	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 50" / 173E 54' 00"	7020014	Liver	E/O	70.70%
93COA29L	Adult	M	2-Jun-93	Agattu Island	52N 26' 00" / 173E 36' 00"	7020014	Liver	E/O	70.20%
93COA30L	Adult	M	2-Jun-93	Agattu Island	52N 26' 00" / 173E 36' 00"	7020014	Liver	E/O	70.80%
93COA31L	Adult	F	2-Jun-93	Agattu Island	52N 26' 00" / 173E 36' 00"	7020014	Liver	E/O	70.50%
93COA32L	Adult	F	2-Jun-93	Agattu Island	52N 26' 00" / 173E 36' 00"	7020014	Liver	E/O	67.30%
93COA33L	Adult	F	2-Jun-93	Agattu Island	52N 26' 00" / 173E 36' 00"	7020014	Liver	E/O	68.30%
93COA34L	Adult	F	2-Jun-93	Agattu Island	52N 26' 00" / 173E 36' 00"	7020014	Liver	E/O	67.20%
93COA35L	Adult	F	2-Jun-93	Agattu Island	52N 26' 00" / 173E 36' 00"	7020014	Liver	E/O	69.90%
93COA36L	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 50" / 173E 54' 00"	7020014	Liver	E/O	72.60%

Appendix A (continued)

Bird ID No.:	Age:	Sex:	Date Collected:	Location:	Latitude / Longitude:	EC/MS:	Tissue Type:	Analysis	Moisture:
93COA37L	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 50" / 173E 54' 00"	7020014	Liver	E/O	67.20%
93COA38L	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 50" / 173E 54' 00"	7020014	Liver	E/O	67.00%
93COA39L	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 50" / 173E 54' 00"	7020014	Liver	E/O	68.20%
93COA40L	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 50" / 173E 54' 00"	7020014	Liver	E/O	70.00%
93COA41L	Adult	M	4-Jun-93	Alaid / Nizki Islands	52N 45' 50" / 173E 54' 00"	7020014	Liver	E/O	71.60%
93COA46L	Adult	F	12-Jun-93	Amchitka Island	51N 32' 00" / 179E 00' 00"	7020014	Liver	E/O	64.60%
93COA7L	Adult	F	4-Jun-93	Alaid / Nizki Islands	52N 45' 00" / 173E 54' 00"	7020014	Liver	E/O	69.40%
93COA8L	Adult	F	4-Jun-93	Alaid / Nizki Islands	52N 45' 00" / 173E 54' 00"	7020014	Liver	E/O	68.10%
93COA9L	Adult	F	4-Jun-93	Alaid / Nizki Islands	52N 45' 00" / 173E 54' 00"	7020014	Liver	E/O	69.60%
02K	Adult	M	3-Jun-93	Nizki Island	52N 44' 10" / 173E 59' 00"	7010015	Kidney	E	75.35%
03K	Adult	M	3-Jun-93	Nizki Island	52N 44' 10" / 173E 59' 00"	7010015	Kidney	E	77.63%
04K	Adult	M	3-Jun-93	Nizki Island	52N 44' 10" / 173E 59' 00"	7010015	Kidney	E	76.21%
05K	Adult	M	3-Jun-93	Nizki Island	52N 44' 10" / 173E 59' 00"	7010015	Kidney	E	75.71%
02L	Adult	M	3-Jun-93	Nizki Island	52N 44' 10" / 173E 59' 00"	7010015	Liver	E	68.84%
03L	Adult	M	3-Jun-93	Nizki Island	52N 44' 10" / 173E 59' 00"	7010015	Liver	E	69.67%
04L	Adult	M	3-Jun-93	Nizki Island	52N 44' 10" / 173E 59' 00"	7010015	Liver	E	67.52%
05L	Adult	M	3-Jun-93	Nizki Island	52N 44' 10" / 173E 59' 00"	7010015	Liver	E	71.37%
93COA42K	Adult	F	3-Aug-93	Amchitka Island	51N 32' 00" / 179E 00' 00"	7020029	Kidney	E	75.00%
93COA43K	Adult	F	3-Aug-93	Amchitka Island	51N 32' 00" / 179E 00' 00"	7020029	Kidney	E	77.50%
93COA44K	Juvenile	F	3-Aug-93	Amchitka Island	51N 32' 00" / 179E 00' 00"	7020029	Kidney	E	76.30%
93COA45K	Adult	F	3-Jul-93	Amchitka Island	51N 32' 00" / 179E 00' 00"	7020029	Kidney	E	76.10%
93COA46K	Adult	F	3-Jul-93	Amchitka Island	51N 32' 00" / 179E 00' 00"	7020029	Kidney	E	75.80%
93COA47K	Adult	F	3-Jul-93	Amchitka Island	51N 32' 00" / 179E 00' 00"	7020029	Kidney	E	75.40%
93COA48K	Adult	F	3-Jul-93	Amchitka Island	51N 32' 00" / 179E 00' 00"	7020029	Kidney	E	75.50%
93COKR1K	Adult	F	12-Jun-93	YK Delta	61N 17' 00" / 165W 37' 00"	7020029	Kidney	E	73.80%
93COA42L	Adult	F	3-Aug-93	Amchitka Island	51N 32' 00" / 179E 00' 00"	7020029	Liver	E	69.50%
93COA43L	Adult	F	3-Aug-93	Amchitka Island	51N 32' 00" / 179E 00' 00"	7020029	Liver	E	74.20%
93COA44L	Juvenile	F	3-Aug-93	Amchitka Island	51N 32' 00" / 179E 00' 00"	7020029	Liver	E	69.80%
93COA45L	Adult	F	3-Jul-93	Amchitka Island	51N 32' 00" / 179E 00' 00"	7020029	Liver	E	71.00%
93COA46L	Adult	F	3-Jul-93	Amchitka Island	51N 32' 00" / 179E 00' 00"	7020029	Liver	E	70.10%
93COA47L	Adult	F	3-Jul-93	Amchitka Island	51N 32' 00" / 179E 00' 00"	7020029	Liver	E	67.40%
93COA48L	Adult	F	3-Jul-93	Amchitka Island	51N 32' 00" / 179E 00' 00"	7020029	Liver	E	71.00%
93COKR1L	Adult	F	12-Jun-93	YK Delta	61N 17' 00" / 165W 37' 00"	7020029	Liver	E	73.40%
94COSL1K	Adult	F	9-May-94	St. Lawrence Island	67N 17' 00" / 165W 35' 00"	7020033	Kidney	E	76.50%
94COSL1L	Adult	F	9-May-94	St. Lawrence Island	67N 17' 00" / 165W 35' 00"	7020033	Liver	E	69.40%

spectacled eider (*Somateria fischeri*)

Appendix A (continued)

Bird ID No.:	Age:	Sex:	Date Collected:	Location:	Latitude / Longitude:	ECDMS	Tissue Type:	Analysis	Moisture:
91SPSL1	Adult	M	28-Nov-91	St. Lawrence Island	63N 47' 00" / 171W 45' 00"	7020008	Kidney	E	74.30%
91SPSL4	Adult	F	28-Nov-91	St. Lawrence Island	63N 47' 00" / 171W 45' 00"	7020008	Kidney	E	71.00%
91SPSL6	Adult	M	28-Nov-91	St. Lawrence Island	63N 47' 00" / 171W 45' 00"	7020008	Kidney	E	72.20%
91SPSL2	Adult	M	28-Nov-91	St. Lawrence Island	63N 47' 00" / 171W 45' 00"	7020008	Liver	E	69.20%
91SPSL3	Adult	F	28-Nov-91	St. Lawrence Island	63N 47' 00" / 171W 45' 00"	7020008	Liver	E	66.80%
91SPSL5	Adult	M	28-Nov-91	St. Lawrence Island	63N 47' 00" / 171W 45' 00"	7020008	Liver	E	67.90%
92SPHS1K	Adult	F	6-Jul-92	Hock Slough (YKD)	61N 18' 00" / 165W 36' 00"	7020013	Kidney	E	78.00%
92SPHS2K	Juvenile	F	10-Aug-92	Hock Slough (YKD)	61N 18' 00" / 165W 36' 00"	7020013	Kidney	E	78.70%
92SPHS1L	Adult	F	6-Jul-92	Hock Slough (YKD)	61N 18' 00" / 165W 36' 00"	7020013	Liver	E	68.10%
92SPHS2L	Juvenile	F	10-Aug-92	Hock Slough (YKD)	61N 18' 00" / 165W 36' 00"	7020013	Liver	E	71.90%
93SPBA1K	Juvenile	F	23-Sep-93	Barrow	71N 50' 00" / 157W 00' 00"	7020029	Kidney	E	74.20%
93SPHS1K	Adult	M	1-Jun-93	Hock Slough (YKD)	61N 17' 00" / 165W 37' 00"	7020029	Kidney	E	78.10%
93SPHS2K	Adult	F	21-Jul-93	Hock Slough (YKD)	61N 17' 00" / 165W 37' 00"	7020029	Kidney	E	85.30%
93SPKR1K	Adult	M	8-Jun-93	YK Delta	61N 17' 00" / 165W 37' 00"	7020029	Kidney	E	74.70%
93SPBA1L	Juvenile	F	23-Sep-93	Barrow	71N 50' 00" / 157W 00' 00"	7020029	Liver	E	70.30%
93SPHS1L	Adult	M	1-Jun-93	Hock Slough (YKD)	61N 17' 00" / 165W 37' 00"	7020029	Liver	E	72.70%
93SPHS2L	Adult	F	21-Jul-93	Hock Slough (YKD)	61N 17' 00" / 165W 37' 00"	7020029	Liver	E	82.30%
93SPKR1L	Adult	M	8-Jun-93	YK Delta	61N 17' 00" / 165W 37' 00"	7020029	Liver	E	73.80%
94SPHS1K	Adult	M	11-Jun-94	Hock Slough (YKD)	67N 17' 00" / 165W 35' 00"	7020033	Kidney	E	74.60%
94SPHS2K	Adult	F	12-Jul-94	Hock Slough (YKD)	67N 17' 00" / 165W 35' 00"	7020033	Kidney	E	82.20%
94SPHS3K	Adult	F	30-Jun-94	Hock Slough (YKD)	67N 17' 00" / 165W 35' 00"	7020033	Kidney	E	79.80%
94SPPK1K	Adult	F	12-Jun-94	Kigigak Island (YKD)	67N 17' 00" / 165W 35' 00"	7020033	Kidney	E	79.70%
94SPPK12K	Adult	F	27-Jun-94	Kigigak Island (YKD)	67N 17' 00" / 165W 35' 00"	7020033	Kidney	E	78.60%
94SPS1K	Sub-adult	M	6-May-94	St. Lawrence Island	67N 17' 00" / 165W 35' 00"	7020033	Kidney	E	81.80%
94SPHS1L	Adult	M	11-Jun-94	Hock Slough (YKD)	67N 17' 00" / 165W 35' 00"	7020033	Liver	E	74.70%
94SPHS2L	Adult	F	12-Jul-94	Hock Slough (YKD)	67N 17' 00" / 165W 35' 00"	7020033	Liver	E	79.30%
94SPHS3L	Adult	F	30-Jun-94	Hock Slough (YKD)	67N 17' 00" / 165W 35' 00"	7020033	Liver	E	76.50%
94SPPK11L	Adult	F	12-Jun-94	Kigigak Island (YKD)	67N 17' 00" / 165W 35' 00"	7020033	Liver	E	76.10%
94SPPK12L	Adult	F	27-Jun-94	Kigigak Island (YKD)	67N 17' 00" / 165W 35' 00"	7020033	Liver	E	72.60%
94SPS1L	Sub-adult	M	6-May-94	St. Lawrence Island	67N 17' 00" / 165W 35' 00"	7020033	Liver	E	79.20%
95SPD1K	Adult	M	7-Jun-95	Indigirka River Delta	71N 16' 24" / 150E 17' 31"	7020041	Kidney	E	76.20%
95SPD2K	Adult	F	7-Jun-95	Indigirka River Delta	71N 16' 24" / 150E 17' 31"	7020041	Kidney	E	74.80%

Appendix A (continued)

Bird ID No.:	Age:	Sex:	Date Collected:	Location:	Latitude / Longitude:	ECDMS	Tissue Type:	Analysis	Moisture:
95SPID3K	Adult	M	7-Jun-95	Indigirka River Delta	71N 16' 24" / 150E 17' 31"	7020041	Kidney	E	75.50%
95SPID1L	Adult	M	7-Jun-95	Indigirka River Delta	71N 16' 24" / 150E 17' 31"	7020041	Liver	E/O	64.40%
95SPID2L	Adult	F	7-Jun-95	Indigirka River Delta	71N 16' 24" / 150E 17' 31"	7020041	Liver	E/O	65.70%
95SPID3L	Adult	M	7-Jun-95	Indigirka River Delta	71N 16' 24" / 150E 17' 31"	7020041	Liver	E/O	65.40%

Steller's eider (*Polyysticia stellaris*)

Bird ID No.:	Age:	Sex:	Date Collected:	Location:	Latitude / Longitude:	ECDMS	Tissue Type:	Analysis	Moisture:
92STTG1K	Adult	F	10-Jun-92	Togik	58N 34' 50" / 161W 44' 00"	7020013	Kidney	E	79.20%
92STTG1L	Adult	F	10-Jun-92	Togik	58N 34' 50" / 161W 44' 00"	7020013	Liver	E	72.50%
93STBA1K	Adult	F	13-Jun-93	Barrow	71N 18' 00" / 156W 43' 00"	7020029	Kidney	E	73.00%
93STBA2K	Adult	M	15-Jun-93	Barrow	71N 18' 00" / 156W 43' 00"	7020029	Kidney	E	73.60%
93STBA3K	Adult	M	16-Jun-93	Barrow	71N 18' 00" / 156W 43' 00"	7020029	Kidney	E	75.10%
93STBA1L	Adult	F	13-Jun-93	Barrow	71N 18' 00" / 156W 43' 00"	7020029	Liver	E/O	66.70%
93STBA2L	Adult	M	15-Jun-93	Barrow	71N 18' 00" / 156W 43' 00"	7020029	Liver	E/O	66.90%
93STBA3L	Adult	M	16-Jun-93	Barrow	71N 18' 00" / 156W 43' 00"	7020029	Liver	E/O	70.00%
94STD1K	Adult	F	14-Jun-94	Indigirka River Delta	71N 16' 24" / 150E 17' 31"	7020033	Kidney	E/O	ND
94STD2K	Adult	M	14-Jun-94	Indigirka River Delta	71N 16' 24" / 150E 17' 31"	7020033	Kidney	E/O	77.50%
94STKOIK	Adult	F	2-Feb-94	Bering Sea	67N 17' 00" / 165W 35' 00"	7020033	Kidney	E	76.60%
94STD1L	Adult	F	14-Jun-94	Indigirka River Delta	71N 16' 24" / 150E 17' 31"	7020033	Liver	E/O	72.40%
94STD2L	Adult	M	14-Jun-94	Indigirka River Delta	71N 16' 24" / 150E 17' 31"	7020033	Liver	E/O	74.10%
94STKOIL	Adult	F	2-Feb-94	Bering Sea	67N 17' 00" / 165W 35' 00"	7020033	Liver	E	70.90%

¹ Age was based on plumage

² M = male; F = female

³ Alaid, Attu, Agattu, Adak and Amchitka islands are located in the Aleutian Island Archipelago, while Hock Slough and Kigigak Island are part of the Yukon Kuskokwim River Delta system (denoted as YKD or YK Delta)

⁴ ECDMS = Environmental Contaminants Data Management System catalog number

⁵ E = Elemental analysis only; E/O = Elemental and organochlorine analysis

⁶ ND = No Data

Appendix B:

Elemental residues found in eider liver tissues

common eider (*Somateria mollissima*)

Bird ID	Al	As	B	Ba	Be	Cd	Cr	Cu	Fe	Hg	Mg	Mn	Mo	Ni	Pb	Se	Sr	V	Zn	QA/QC COMMENTS
92COHSIL	<0.98	0.57	1.48	<0.20	<0.02	18.62	<0.35	55.67	2,964.54	4.26	843.97	32.66	5.67	1.83	187.23	43.97	1.28	11.63	414.89	
93COA10L	<0.00	0.20	4.00	<0.10	25.50	0.50	941.00	1,140.00	2.86	560.00	12.00	7.00	<0.50	<0.20	14.00	0.55	<0.30	114.00		
93COA11L	<0.00	0.61	<0.00	<0.10	9.63	<0.40	476.00	1,350.00	1.14	641.00	14.00	7.10	<0.50	<0.20	12.60	2.00	<0.30	98.90	44 RPD for As	
93COA12L	<0.00	0.45	<0.00	<0.10	22.70	<0.40	723.00	1,120.00	2.39	776.00	19.00	5.50	<0.50	<0.20	12.60	1.40	<0.30	130.00		
93COA13L	6.00	0.47	<0.00	<0.10	27.00	0.50	1,090.00	1,040.00	1.70	698.00	16.00	6.90	<0.50	<0.20	11.90	1.40	<0.30	160.00		
93COA14L	<0.00	1.40	3.00	<0.10	19.00	0.40	534.00	914.00	2.10	680.00	12.00	8.50	<0.50	<0.20	10.40	1.00	<0.30	118.00	50.6% spike recovery for Cu	
93COA15L	<0.00	1.20	3.00	<0.10	32.70	0.50	205.00	637.00	1.78	721.00	16.00	5.90	<0.50	<0.20	2.00	0.59	<0.30	152.00		
93COA16L	<0.00	<0.10	2.00	<0.10	10.60	<0.40	856.00	819.00	1.49	700.00	12.00	3.90	<0.50	<0.20	8.00	0.58	<0.30	103.00		
93COA17L	<0.00	0.44	3.00	<0.10	22.60	<0.40	649.00	652.00	2.12	788.00	15.00	5.30	<0.50	<0.20	12.20	0.89	<0.30	141.00		
93COA18L	<0.00	0.10	3.00	<0.10	4.29	<0.40	238.00	689.00	3.60	651.00	15.00	3.90	<0.50	<0.20	7.20	0.56	<0.30	109.00		
93COA19L	5.00	0.47	<2.00	<0.10	17.90	2.50	403.00	1,050.00	1.98	730.00	15.00	4.10	<0.50	<0.20	11.00	0.76	<0.30	132.00		
93COA1IL	5.00	0.20	<2.00	<0.10	19.30	<0.40	914.00	1,180.00	3.00	780.00	16.00	5.10	<0.50	<0.20	17.00	0.30	<0.30	124.00		
93COA20L	<0.00	0.20	2.00	<0.10	0.10	14.70	<0.40	454.00	731.00	2.70	677.00	13.00	4.00	<0.50	<0.20	10.60	0.66	<0.30	125.00	
93COA21L	<0.00	0.33	2.00	<0.10	20.70	0.40	510.00	1,550.00	1.27	756.00	16.00	3.00	<0.50	<0.20	9.40	0.80	<0.30	127.00		
93COA22L	<0.00	0.33	3.00	<0.10	31.30	<0.40	175.00	619.00	3.80	663.00	11.00	2.00	<0.50	<0.20	10.00	0.77	<0.30	110.00		
93COA23L	<0.00	0.20	<2.00	<0.10	40.90	1.20	38.00	1,190.00	1.33	674.00	15.00	2.00	<0.50	<0.20	8.40	1.10	<0.30	128.00		
93COA24L	<0.00	0.20	2.00	<0.10	22.40	<0.40	40.00	2,610.00	1.11	560.00	16.00	2.00	<0.50	<0.20	5.80	0.52	<0.30	340.00		
93COA25L	<0.00	0.20	<2.00	<0.10	20.80	0.40	1,600.00	1,380.00	1.50	680.00	17.00	3.70	<0.50	<0.20	10.40	0.41	<0.30	133.00		
93COA26L	6.00	0.20	5.00	<0.10	25.50	<0.40	522.00	990.00	1.37	742.00	16.00	5.40	<0.50	<0.20	13.00	0.53	<0.30	141.00		
93COA27L	<0.00	0.36	<2.00	<0.10	23.20	0.20	824.00	1,670.00	1.50	663.00	20.50	7.80	<0.50	<0.20	7.00	0.51	<0.30	152.00		
93COA28L	<0.00	0.30	2.00	<0.10	14.60	0.36	1,770.00	1,520.00	1.70	552.00	11.00	6.20	<0.50	<0.20	9.50	0.53	<0.30	104.00		
93COA29L	<0.00	0.20	2.00	<0.10	22.40	<0.40	40.00	2,610.00	1.11	560.00	16.00	2.00	<0.50	<0.20	8.20	1.40	<0.30	110.00	40 RPD for As	
93COA30L	<0.00	0.20	<2.00	<0.10	20.30	<0.10	726.00	1,280.00	1.80	666.00	12.00	4.70	<0.50	<0.20	8.10	1.70	<0.30	123.00		
93COA31L	<0.00	0.20	<2.00	<0.10	12.50	<0.10	14.00	266.00	0.65	798.00	12.00	1.00	<0.50	<0.20	3.80	1.80	<0.30	107.00		
93COA32L	9.00	0.30	<2.00	<0.10	9.65	0.10	48.00	336.00	1.60	672.00	14.00	2.00	<0.50	<0.20	7.20	1.20	<0.30	87.60		
93COA33L	<0.00	0.10	3.00	<0.10	6.42	<0.10	53.60	862.00	1.10	781.00	16.00	2.00	<0.50	<0.20	6.70	0.77	<0.30	108.00		
93COA34L	<0.00	0.32	<2.00	<0.10	10.70	<0.10	116.00	412.00	0.94	768.00	11.00	2.00	<0.50	<0.20	2.50	30.40	<0.30	78.80		
93COA35L	4.00	0.32	<2.00	<0.10	14.80	<0.10	30.00	582.00	1.20	805.00	15.00	2.00	<0.50	<0.20	5.80	1.80	<0.30	97.00		
93COA36L	<0.00	0.44	3.00	<0.10	21.90	0.10	543.00	1,590.00	1.30	634.00	14.00	5.10	<0.50	<0.20	9.40	1.00	<0.30	114.00	75 RPD for B; 66.67 RPD for Cr	
93COA37L	<0.00	0.30	<2.00	<0.10	29.40	<0.10	1,160.00	1,970.00	4.24	636.00	18.00	6.00	<0.50	<0.20	10.00	0.35	<0.30	181.00		
93COA38L	<0.00	0.30	4.00	<0.10	18.10	<0.10	282.00	1,620.00	1.20	637.00	15.00	3.00	<0.50	<0.20	6.10	0.30	<0.30	110.00		
93COA39L	<0.00	0.42	<2.00	<0.10	8.22	0.10	337.00	545.00	1.00	687.00	19.00	6.00	<0.50	<0.20	7.80	0.36	<0.30	111.00	60.24% spike recovery for Cu	
93COA40L	<0.00	0.38	2.00	<0.10	24.70	<0.10	762.00	882.00	2.20	590.00	11.00	4.20	<0.50	<0.20	11.00	0.42	<0.30	103.00		
93COA41L	<0.00	0.72	3.00	<0.10	13.50	<0.10	662.00	522.00	1.50	779.00	12.00	4.70	<0.50	<0.20	11.00	1.30	<0.30	103.00		
93COA46L	<0.00	0.63	2.00	<0.10	10.80	<0.10	34.00	841.00	1.70	592.00	13.00	<1.00	<0.50	<0.20	8.90	0.31	<0.30	92.60		
93COA7L	<0.00	0.44	<2.00	<0.10	11.30	<0.10	85.10	1,090.00	0.56	679.00	11.00	1.00	<0.50	<0.20	4.90	1.60	<0.30	110.00		
93COA8L	<0.00	0.97	<2.00	<0.10	14.20	0.30	80.70	451.00	1.60	767.00	16.00	2.00	<0.50	<0.20	3.60	1.40	<0.30	134.00		
93COA9L	<0.00	0.32	<2.00	<0.10	13.90	0.10	44.00	923.00	1.30	780.00	16.00	2.00	<0.50	<0.20	6.10	0.72	<0.30	111.00		
02L	<31.46	<31.46	<31.46	<31.14	<31.14	<31.14	<31.15	449.24	1,379.81	2.52	705.95	<31.46	8.02	<3.15	<6.29	6.23	<31.15	<144.40		
03L	<31.10	<31.10	<31.10	<31.11	<31.11	<31.11	<31.11	428.58	2,011.03	2.00	791.23	<31.10	5.27	<3.11	<6.22	8.29	<31.11	<158.25		

Appendix B (continued)

Bird ID	Al	As	B	Ba	Be	Cd	Cr	Cu	Fe	Hg	Mg	Mn	Mo	Ni	Pb	Se	Sr	V	Zn	QA/QC COMMENTS
04L	<24.44	<24.44	<24.45	<24.44	<2.44	40.03	<2.44	800.61	708.23	1.91	800.61	<24.45	6.16	<2.44	<4.89	7.54	<2.44	<2.44	169.36	197.24 RPD for B; 47.69 RPD for Cd; 310.38 RPD for Cr; 20.55 RPD for Fe; 70.44 RPD for Mg
05L	<26.47	<26.47	<26.48	<2.65	<2.65	27.25	<2.65	1,292.57	803.49	2.43	838.42	<26.48	3.14	<2.65	<3.29	21.17	<2.65	<2.65	157.20	
93COA42L	8.00	0.20	<2.00	<0.10	<0.10	14.00	<0.10	74.40	947.00	1.50	720.00	15.00	2.00	<0.10	<0.40	8.80	0.85	<0.30	123.00	
93COA43L	<5.00	0.30	<2.00	<0.10	<0.10	27.50	<0.10	66.40	3,620.00	1.80	711.00	13.00	1.00	<0.10	0.70	5.70	1.10	0.80	110.00	40 RPD for As; 66.67 RPD for Mo
93COA44L	<5.00	0.10	<2.00	<0.10	<0.10	16.00	<0.10	101.00	1,620.00	2.10	670.00	18.00	2.00	0.10	<0.40	4.70	0.32	0.30	135.00	132.34% spike recovery for Cu; 120.05% spike recovery for Hg
93COA45L	<5.00	<0.10	<2.00	<0.10	<0.10	40.90	<0.10	394.00	4,350.00	5.00	666.00	21.40	2.00	<0.10	1.00	5.30	0.31	0.90	289.00	
93COA46L	<5.00	0.20	<2.00	<0.10	<0.10	14.00	<0.10	333.00	2,060.00	1.20	724.00	17.00	3.00	<0.10	<0.40	5.20	0.81	0.40	142.00	
93COA47L	<5.00	0.30	2.00	<0.10	<0.10	23.00	<0.10	350.00	1,040.00	4.20	862.00	17.00	3.00	0.10	<0.40	14.00	7.50	<0.30	141.00	
93COA48L	5.00	0.10	<2.00	<0.10	<0.10	32.60	<0.10	507.00	1,250.00	2.40	763.00	19.00	3.50	<0.10	<0.40	14.00	0.69	<0.30	165.00	66.67 RPD for As; 66.67 RPD for V
93COKRIL	<5.00	<0.10	<2.00	<0.10	<0.10	7.50	<0.10	22.00	4,710.00	1.20	608.00	9.50	<1.00	<0.10	0.80	38.00	0.54	1.60	184.00	
94COSL1L	<3.25	0.78	1.33	<0.65	<0.07	21.90	0.55	321.24	1,215.69	2.44	705.88	24.64	3.86	<0.39	<1.62	23.93	0.42	<0.16	149.35	

spectacled eider (*Somateria fischeri*)

Bird ID	Al	As	B	Ba	Be	Cd	Cr	Cu	Fe	Hg	Mg	Mn	Mo	Ni	Pb	Se	Sr	V	Zn	QA/QC COMMENTS
91SPS1L2	<4.94	0.53	1.97	<0.49	<0.10	30.10	<0.49	17.30	1,040.00	0.47	540.00	13.50	1.99	<0.49	<0.50	76.60	0.44	<0.49	112.00	43.96 RPD for B
91SPS1L3	<4.92	0.56	1.47	<0.49	<0.10	5.23	<0.49	345.00	1,440.00	1.07	511.00	11.50	3.73	<0.49	1.11	74.90	0.38	<0.49	95.00	
91SPS1L5	5.52	<0.50	<0.50	<0.49	<0.10	30.20	<0.49	11.60	2,300.00	0.36	799.00	21.00	2.35	<0.49	1.54	35.40	0.65	<0.49	146.00	
92SPHS1L	<0.99	0.50	<1.24	<0.20	<0.02	47.34	0.38	884.01	6,927.90	1.25	485.89	21.38	3.95	<0.37	76.49	28.43	1.19	2.98	215.67	
92SPHS2L	<1.00	0.03	<1.42	<0.20	<0.02	0.11	0.50	83.99	1,793.59	0.67	567.28	15.52	1.47	<0.42	<1.77	4.98	2.07	0.62	92.53	
93SPBA1L	16.00	0.49	<2.00	<0.10	<0.10	0.68	0.10	313.00	663.00	0.81	694.00	20.00	2.00	<0.10	<0.40	46.00	0.85	<0.30	113.00	242.4% spike recovery for Cu
93SPHS1L	<5.00	<0.10	<2.00	<0.10	<0.10	71.30	0.10	866.00	2,350.00	1.70	638.00	17.00	4.00	<0.10	0.80	110.00	0.20	0.50	115.00	
93SPHS2L	<5.00	<0.10	<2.00	<0.31	<0.10	41.20	<0.10	677.00	9,970.00	1.30	801.00	10.00	<1.00	<0.10	135.00	37.00	4.50	3.50	201.00	
93SPKR1L	<5.00	0.10	<2.00	<0.10	<0.10	42.60	<0.10	936.00	2,720.00	2.00	708.00	14.00	3.00	<0.10	0.50	78.00	0.75	0.60	141.00	
94SPHS1L	<3.89	0.32	2.56	<0.78	<0.08	56.92	<0.77	1,521.74	2,474.31	1.66	743.08	12.53	3.19	0.54	<1.94	143.87	0.33	<0.19	181.03	
94SPHS2L	7.78	0.43	2.92	<1.17	<0.12	179.23	0.77	3,695.65	1,555.56	3.18	835.75	15.94	9.90	1.24	174.88	101.45	0.80	<0.29	608.70	
94SPHS3L	<5.15	0.34	<2.06	<0.03	<0.10	62.98	1.07	372.77	7,489.36	1.42	774.47	14.34	3.86	0.95	<2.57	30.99	0.90	<0.26	154.89	
94SPK11L	<5.06	<0.21	2.21	<1.01	<0.10	80.33	2.86	389.54	8,493.73	2.02	694.56	22.55	6.74	3.49	102.09	23.26	0.81	<0.26	121.76	
94SPK21L	<3.59	<0.18	<1.44	<0.72	<0.07	113.50	2.05	1,051.10	10,620.44	1.54	686.13	13.72	8.25	1.91	<1.80	81.02	0.42	<0.18	285.04	
94SPSL1L	<4.78	1.01	3.57	<0.96	<0.10	82.21	5.43	2,538.46	6,153.84	5.67	754.81	13.65	7.74	6.39	<2.39	40.48	1.17	<0.24	400.96	
95SPID1L	4.72	0.84	15.84	<0.56	<0.06	69.66	0.47	898.88	1,657.30	1.98	651.69	26.97	5.20	0.37	<1.40	211.52	0.17	0.45	190.45	
95SPID2L	<2.09	0.73	15.10	<0.58	<0.06	49.85	0.47	233.82	973.76	1.13	630.15	18.25	2.62	0.36	<1.45	234.99	0.23	0.28	144.90	
95SPID3L	<2.86	0.64	1.29	<0.57	<0.06	51.16	0.40	1,416.18	1,742.77	1.34	566.47	14.65	3.70	<0.34	<1.43	280.92	0.25	0.46	131.79	

Appendix B (continued)

Steller's eider (*Polyysticia stellaris*)

Bird ID	Al	As	B	Ba	Be	Cd	Cr	Cu	Fe	Hg	Mg	Mn	Mo	Ni	Pb	Se	Sr	V	Zn	QA/QC COMMENTS
92STTGIL	<0.99	1.42	<1.43	<0.20	<0.02	1.24	0.39	38.18	1,200.00	2.12	589.09	9.31	<1.79	0.63	<1.79	8.18	9.31	0.75	138.18	
93STBAIL	<5.00	<0.10	<2.00	<0.10	<0.10	8.60	<0.10	40.60	3,240.00	2.20	752.00	17.00	3.00	<0.10	1.70	26.00	0.20	1.60	123.00	
93STBA2L	<5.00	0.20	<2.00	0.61	<0.10	7.40	<0.10	21.00	1,120.00	2.90	701.00	13.00	2.00	<0.10	<0.40	34.00	0.30	0.60	119.00	
93STBA3L	<5.00	<0.10	<2.00	0.20	<0.10	6.60	<0.10	34.30	4,390.00	2.50	710.00	17.00	3.00	<0.10	26.00	13.00	0.10	0.96	104.00	
94STD1L	<3.58	0.47	130.07	<0.72	<0.07	8.15	1.86	41.30	1,847.83	3.24	811.59	19.93	2.70	1.68	<1.79	31.45	0.24	<0.18	113.77	66.67 RPD for As; 60% spike recovery for Hg; 78.91% spike recovery for Se
94STD2L	<4.79	0.69	2.63	<0.36	<0.10	17.72	1.62	77.99	5,944.56	7.61	818.53	32.47	4.40	1.65	<2.4	56.76	<0.24	0.51	153.67	
94STKOIL	<3.41	2.61	<1.36	<0.68	<0.07	9.35	1.29	24.09	2,738.83	2.86	728.52	18.21	2.97	0.90	<1.7	17.70	0.64	<0.17	101.03	

Residues for which at least 50% of the samples were below the detection limit are highlighted in bold face type.
 Values are reported in parts per million (ppm) dry weight concentrations.

Appendix C:

Elemental residues found in eider kidney tissues

common eider (*Somateria mollissima*)

Bird ID	Al	As	B	Ba	Be	Cd	Cr	Cu	Fe	Hg	Mg	Mn	Mo	Ni	Pb	Se	Sr	V	Zn	QA/QC COMMENTS
92COHS1K	<0.99	0.99	0.98	<0.98	<0.02	68.47	0.85	66.50	1,566.50	1.32	862.07	13.10	1.00	0.79	91.63	57.14	2.44	1.21	210.34	
93COA10K	<3.00	0.64	4.00	0.10	<0.20	131.00	0.10	35.00	985.00	1.30	604.00	6.80	2.00	<0.50	<0.20	6.20	0.91	0.30	129.00	
93COA11K	4.00	0.36	6.50	0.20	<0.10	46.40	0.10	36.00	814.00	0.59	769.00	8.10	2.00	<0.50	<0.20	4.10	3.50	0.40	113.00	
93COA12K	<3.00	0.36	3.00	0.10	<0.10	142.00	0.05	45.00	442.00	1.20	927.00	12.00	3.00	<0.50	<0.20	7.10	2.00	<0.30	170.00	
93COA13K	<3.00	0.20	4.00	<0.10	<0.10	141.00	0.10	53.00	460.00	0.87	847.00	9.30	3.00	<0.50	<0.20	6.10	5.20	<0.30	190.00	
93COA14K	<3.00	0.20	4.00	0.20	<0.10	86.50	0.40	33.00	729.00	0.95	790.00	8.80	2.00	<0.60	<0.20	4.60	1.50	0.30	129.00	69.83% spike recovery for Se
93COA15K	<3.00	0.20	5.00	0.10	<0.10	123.00	0.20	38.00	478.00	0.73	859.00	12.00	3.00	<0.50	<0.20	4.60	1.20	<0.30	156.00	
93COA16K	<3.00	0.35	4.00	0.10	<0.10	57.20	0.20	48.00	643.00	0.81	962.00	11.00	2.00	<0.50	<0.20	4.00	2.80	0.30	132.00	82.35 RPD for Ni
93COA17K	<3.00	0.41	4.00	<0.10	0.10	155.00	0.10	62.40	441.00	1.30	957.00	12.00	3.10	<0.50	<0.20	7.00	3.00	<0.30	174.00	
93COA18K	<3.00	0.58	6.00	<0.10	<0.10	102.00	0.10	26.00	592.00	2.10	747.00	12.00	2.00	<0.50	<0.20	5.50	1.10	<0.30	92.40	
93COA19K	<3.00	0.37	3.00	0.20	<0.10	88.50	0.20	43.00	597.00	1.30	954.00	9.00	2.00	<0.50	<0.20	5.30	13.30	0.30	146.00	
93COA1K	<6.00	0.40	2.00	0.30	<0.2	103.00	0.87	51.00	518.00	1.40	1,070.00	13.00	3.00	<1.0	43.60	6.60	9.80	<0.60	153.00	66.18% spike recovery for Hg
93COA20K	<3.00	0.42	3.00	0.10	<0.10	53.60	<0.10	42.00	537.00	1.40	704.00	8.20	2.00	<0.50	<0.20	6.40	1.10	<0.30	124.00	
93COA21K	<3.00	0.20	4.00	0.10	<0.10	111.00	0.10	61.30	609.00	0.65	916.00	9.70	3.00	<0.50	428.00	6.20	1.60	<0.30	159.00	
93COA22K	<3.00	0.72	5.00	<0.10	0.10	82.70	<0.10	35.00	485.00	3.10	798.00	7.60	2.00	0.60	<0.20	6.80	3.00	<0.30	111.00	
93COA23K	9.30	0.33	1.00	0.10	<0.10	177.00	0.10	36.00	393.00	0.59	808.00	14.00	3.00	<0.50	<0.20	4.30	3.20	<0.30	140.00	62.5 RPD for As; 66.67 RPD for Cr
93COA24K	<3.00	0.20	1.00	0.20	0.20	151.00	0.32	60.60	704.00	0.79	738.00	7.30	2.00	<0.60	<0.20	9.60	1.00	0.50	246.00	
93COA25K	<3.00	0.64	5.00	0.20	0.20	74.80	0.10	44.00	632.00	0.82	730.00	11.00	3.00	<0.50	<0.20	5.30	3.20	<0.30	127.00	40.99% spike recovery for Sc; 58.23% spike recovery for Sr
93COA26K	<3.00	<0.10	8.30	0.10	<0.10	138.00	0.10	35.00	499.00	0.66	930.00	10.00	3.00	<0.50	<0.20	8.30	1.50	0.30	166.00	
93COA27K	<3.00	0.48	2.00	0.20	<0.10	97.40	<0.10	52.00	683.00	0.86	811.00	10.00	2.00	<0.50	<0.20	6.50	1.60	<0.30	167.00	
93COA28K	<3.00	0.20	3.00	0.20	<0.10	75.50	<0.10	42.00	901.00	0.76	700.00	7.90	2.00	<0.50	<0.20	6.80	1.80	0.30	127.00	
93COA29K	<3.00	0.20	5.00	<0.10	<0.10	69.80	<0.10	59.00	612.00	1.10	818.00	9.70	3.00	<0.50	4.50	6.50	2.20	<0.30	139.00	
93COA30K	<3.00	0.20	4.00	0.10	<0.10	71.00	0.48	54.70	696.00	1.00	832.00	9.90	3.00	0.60	0.84	7.10	3.50	<0.30	131.00	
93COA31K	<3.00	0.10	2.00	0.10	<0.10	72.10	<0.10	30.00	315.00	0.39	830.00	10.00	2.00	<0.50	<0.20	4.40	3.30	<0.30	119.00	
93COA32K	<3.00	0.20	1.00	0.20	<0.10	83.50	0.20	42.00	376.00	0.70	838.00	12.00	2.00	<0.50	<0.20	6.20	2.70	<0.30	123.00	
93COA33K	<3.00	0.20	4.00	0.10	<0.10	16.70	0.30	30.00	719.00	0.60	791.00	9.60	2.00	<0.50	1.40	6.80	2.10	<0.30	99.90	
93COA34K	<3.00	0.33	3.00	0.10	<0.10	86.10	<0.10	41.00	411.00	0.53	874.00	10.00	2.00	<0.50	<0.20	4.80	5.10	<0.30	114.00	
93COA35K	<3.00	0.87	2.00	0.10	<0.10	92.00	0.20	44.00	403.00	0.63	858.00	11.00	2.00	<0.50	<0.20	5.60	3.10	<0.30	134.00	
93COA36K	3.00	0.30	3.00	0.10	0.30	106.00	0.10	27.00	894.00	0.55	847.00	6.70	2.00	1.00	<0.20	5.40	3.90	0.30	132.00	
93COA37K	<3.00	0.30	3.00	0.10	0.20	113.00	0.76	71.30	558.00	1.30	745.00	9.20	2.00	1.00	<0.20	7.30	0.87	<0.30	170.00	
93COA38K	<3.00	0.97	6.70	0.10	<0.10	112.00	0.10	40.00	564.00	0.67	796.00	11.00	2.00	<0.50	<0.20	7.20	0.69	<0.30	147.00	40.99 RPD for As; 66.67 RPD for Ba
93COA39K	5.00	0.35	2.00	<0.10	0.10	24.00	<0.10	32.00	456.00	0.61	714.00	11.00	3.00	<0.50	<0.20	5.40	1.70	<0.30	101.00	
93COA40K	<3.00	0.87	3.00	<0.10	<0.10	109.00	<0.10	42.00	729.00	1.10	667.00	6.40	2.00	<0.50	17.00	6.70	1.50	<0.30	126.00	
93COA41K	<3.00	0.40	6.00	<0.10	0.10	54.10	0.10	44.00	272.00	0.83	899.00	10.00	2.00	<0.50	<0.20	6.20	3.10	<0.30	115.00	
93COA46K	<3.00	0.44	5.00	<0.10	<0.10	31.40	0.10	32.00	463.00	1.20	689.00	9.10	2.00	<0.50	<0.20	9.00	1.30	<0.30	100.00	22.22 RPD for B; 100 RPD for Pb
93COA7K	<3.00	4.20	1.00	<0.10	<0.10	74.10	0.20	31.00	717.00	0.33	648.00	8.90	1.00	<0.60	606.00	4.70	3.80	<0.30	107.00	

Appendix C (continued)

Bird ID	Al	As	B	Ba	Be	Cd	Cr	Cu	Fe	Hg	Mg	Mn	Mo	Ni	Pb	Se	Sr	V	Zn	QA/QC COMMENTS
93COA8K	<3.00	0.91	1.00	<0.10	<0.10	125.00	<0.10	53.50	236.00	0.65	87.00	13.00	2.00	<0.50	0.30	6.30	8.60	<0.30	168.00	
93COA9K	4.00	0.52	3.00	<0.10	<0.10	105.00	0.10	45.00	473.00	0.55	838.00	11.00	3.00	<0.50	0.10	6.30	1.40	<0.30	132.00	
02K	<39.00	<39.00	<39.00	<0.39	<0.39	137.92	<3.90	35.29	892.42	0.94	892.42	<39.00	<3.90	<7.80	5.27	5.68	<3.90	162.26		
03K	<40.64	<40.64	0.43	<0.64	<0.64	183.27	<4.06	44.70	581.11	0.72	938.72	<40.64	<4.06	<8.13	7.44	<4.06	<4.06	183.27		
04K	<32.84	<32.84	<0.33	<0.33	<0.33	128.84	<3.28	189.15	123.52	0.28	882.68	<32.84	<3.28	<6.57	5.96	<3.28	<3.28	210.16		
05K	<34.31	<34.31	<0.34	<0.34	<0.34	123.52	<3.43	31.70	617.38	0.91	988.13	<34.31	<3.43	<3.43	6.86	12.47	<3.43	<3.43	144.10	
93COA42K	160.00	0.20	1.00	0.20	<0.01	72.90	0.05	52.10	784.00	0.76	929.00	12.00	2.00	0.20	0.50	6.80	16.10	1.10	124.00	RPD for Ni
93COA43K	7.00	0.20	1.00	<0.10	<0.01	123.00	0.05	42.00	924.00	1.54	717.00	8.10	2.00	0.20	<0.40	5.00	2.50	0.40	124.00	43.14 RPD for As, 120 RPD for Ni
93COA44K	<5.00	<0.10	1.00	<0.10	<0.01	40.20	0.05	32.10	688.00	1.55	742.00	10.00	2.00	0.10	<0.40	5.00	0.55	<0.30	110.00	79.79% spike recovery for Cu
93COA45K	<5.00	0.10	1.00	<0.10	<0.01	118.00	0.05	56.50	739.00	2.90	726.00	6.40	2.00	0.20	<0.40	7.30	2.90	0.40	178.00	Cd: 77.77% spike recovery for Cu
93COA46K	<5.00	0.10	1.00	<0.10	<0.01	52.50	0.05	28.10	651.00	0.67	721.00	11.00	2.00	<0.10	<0.40	4.60	1.40	<0.30	106.00	
93COA47K	<5.00	0.20	3.00	<0.10	<0.01	105.00	0.05	56.10	303.00	2.70	935.00	12.00	3.30	0.20	<0.40	9.50	1.50	<0.30	149.00	66.67 RPD for As, 66.67 RPD for Ni
93COA48K	6.00	0.20	1.00	<0.10	<0.01	104.00	0.05	46.20	614.00	1.50	843.00	9.20	2.00	<0.10	<0.40	9.50	2.40	0.30	135.00	120.07% spike recovery for Hg
93COKR1K	23.00	<0.10	1.00	0.10	<0.01	34.90	0.05	20.00	955.00	0.47	595.00	3.70	<1.00	0.20	0.50	29.00	0.86	0.40	115.00	
94COSL1K	<5.15	1.66	2.45	<1.03	<0.10	127.23	1.18	117.87	544.68	0.96	770.21	13.19	3.46	1.67	<2.58	13.23	1.56	<0.26	142.98	

*spectacled eider (*Somateria fischeri*)*

Bird ID	Al	As	B	Ba	Be	Cd	Cr	Cu	Fe	Hg	Mg	Mn	Mo	Ni	Pb	Se	Sr	V	Zn	QA/QC COMMENTS
91SPSL1	6.64	2.03	4.24	<0.50	0.16	53.10	0.55	14.40	691.00	0.25	520.00	5.73	2.27	0.96	1.52	45.30	0.71	<0.50	89.90	
91SPSL4	16.30	0.85	1.54	1.20	<0.10	5.78	0.25	33.30	856.00	0.43	431.00	4.15	1.18	<0.49	2.92	58.30	1.86	<0.49	62.10	32.58 RPD for As
91SPSL6	15.80	1.45	0.25	<0.49	<0.10	113.00	0.70	15.00	483.00	0.52	669.00	8.47	2.37	<0.49	16.10	24.60	0.68	<0.49	123.00	74.62% spike recovery for Cd
92SPHS1K	<0.98	0.23	0.89	<0.90	<0.02	136.82	0.66	96.36	1,172.73	0.49	595.45	8.86	0.90	<0.54	59.09	26.77	1.31	0.66	147.73	
92SPHS2K	<1.12	0.28	1.15	<1.05	<0.02	0.15	0.66	38.26	563.38	0.29	807.51	10.33	2.12	<0.63	<2.62	5.35	9.81	<0.26	92.49	
93SPBA1K	<5.00	0.81	1.00	<0.10	<0.01	0.73	0.05	30.50	595.00	0.48	759.00	13.00	3.00	<0.10	<0.40	26.00	1.60	<0.30	89.80	
93SPHS1K	<5.00	<0.10	1.00	<0.10	<0.01	243.00	0.05	47.00	1,180.00	1.00	682.00	8.40	2.00	<0.10	0.50	53.00	0.42	0.50	179.00	
93SPHS2K	<5.00	0.10	1.00	0.10	<0.01	94.30	0.05	49.80	948.00	1.07	735.00	7.60	1.00	<0.10	130.00	20.00	4.00	0.70	137.00	
93SPKR1K	<5.00	0.20	1.00	0.20	<0.01	81.50	0.64	43.90	1,110.00	0.82	693.00	5.40	2.00	0.19	39.20	33.00	1.80	0.40	104.00	
94SPHS1K	6.46	0.35	3.67	<0.96	<0.09	125.20	4.49	129.13	1,114.17	0.74	708.66	8.74	3.53	5.16	<2.40	102.76	0.56	<0.24	143.31	
94SPHS2K	<5.45	0.34	3.28	<1.09	<0.11	319.10	1.03	146.63	1,275.28	1.19	898.88	9.61	<2.18	1.15	110.11	28.65	2.76	0.66	300.56	
94SPHS3K	<4.80	0.89	3.64	<0.96	<0.09	291.58	7.48	94.06	1,014.85	1.00	782.18	9.26	4.94	10.74	<2.40	16.09	1.61	0.67	210.40	
94SPK11K	<5.91	0.39	3.64	<1.18	<0.12	318.23	1.75	114.29	714.29	1.17	817.73	14.29	3.01	1.75	73.40	17.49	1.57	<0.30	163.55	
94SPK12K	<4.53	0.23	0.90	<0.91	<0.09	353.27	1.36	84.58	1,233.65	0.76	1,102.80	10.00	2.63	1.15	<2.27	51.40	6.17	0.77	252.80	
94SPSL1K	<5.48	0.93	2.82	<1.10	<0.11	93.96	2.29	200.55	615.38	1.87	890.11	9.40	3.56	1.74	<2.74	178.57	2.56	<0.27	229.12	
95SPID1K	6.01	1.89	43.70	<0.84	<0.08	217.65	0.82	74.79	785.71	0.04	689.08	12.65	2.75	0.77	<2.10	71.01	0.92	0.25	171.01	
95SPID2K	<3.97	2.34	4.17	<0.79	<0.08	157.94	0.64	67.06	734.13	0.12	634.92	13.45	2.32	<0.48	7.50	68.65	0.99	0.27	150.00	
95SPID3K	<3.97	1.22	4.16	<0.90	<0.08	275.51	0.61	79.59	1,138.78	0.67	746.94	11.43	2.89	<0.48	<1.98	234.29	0.58	0.47	204.49	

Steller's eider (*Polyysticla stelleri*)

Appendix C (continued)

Bird ID	Al	As	B	Ba	Be	Cd	Cr	Cu	Fe	Hg	Mg	Mn	Mo	Ni	Pb	Se	Sr	V	Zn	QA/QC COMMENTS
93STTG1K	4.47	1.68	1.00	<1.00	<0.02	1.96	0.62	21.06	947.12	0.50	1,514.42	17.02	1.05	0.68	<2.73	9.52	28.61	1.09	117.31	
93STBA1K	<5.00	<0.10	1.00	0.10	<0.02	25.90	0.66	24.80	517.00	1.11	788.00	12.00	3.00	0.19	2.66	13.00	0.35	0.30	125.00	
93STBA2K	<5.00	0.10	1.00	1.69	<0.01	37.70	0.05	26.60	462.00	1.15	809.00	13.00	3.40	0.20	<0.40	16.00	0.62	0.98	137.00	
93STBA3K	<5.00	0.34	1.00	0.56	<0.01	33.30	0.05	26.80	634.00	1.69	789.00	14.00	2.00	0.30	93.00	7.20	2.80	<0.3	115.00	
93STTD1K	<2.00	0.16	9.12	<0.40	<0.04	8.87	0.23	8.25	270.00	ND	185.00	6.60	<0.80	0.26	<1.00	4.62	0.13	<0.10	29.30	
93STTD2K	<5.38	0.71	9.38	<1.08	<0.11	50.22	1.10	25.07	440.89	2.50	416.44	9.73	<2.15	1.34	<2.68	18.18	<0.27	<0.27	99.11	
93STKO1K	<4.17	2.05	3.18	<0.83	<0.09	42.14	2.24	50.00	666.67	2.49	769.23	15.04	3.81	2.05	<2.09	12.05	0.57	<0.21	113.68	

Residues for which at least 50% of the samples were below the detection limit are highlighted in bold face type.

Values are reported in parts per million (ppm) dry weight concentrations.

ND = No data

Appendix D:

Organochlorine residues found in eider liver tissues

common eider (*Somateria mollissima*)

Bird ID No.	HCB	PCB Total	PCB-1242	PCB-1248	PCB-1254	PCB-1260	Alpha BHC	Alpha chlordane	Beta BHC	Cis-nonaclor	Delta BHC	Dieldrin	Ecdrin	Gammal BHC
92COHSIL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93COA10L	<0.03	N/A	<0.17	<0.17	<0.17	<0.17	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
93COA11L	<0.04	N/A	<0.18	<0.18	<0.18	<0.18	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
93COA12L	<0.03	N/A	<0.17	<0.17	0.27	<0.17	<0.03	<0.03	<0.03	<0.03	0.03	0.03	<0.03	<0.03
93COA13L	<0.03	N/A	<0.16	<0.16	<0.16	<0.16	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
93COA14L	<0.03	N/A	<0.17	<0.17	0.30	<0.17	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
93COA15L	<0.03	N/A	<0.16	<0.16	<0.16	<0.16	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
93COA16L	<0.04	N/A	<0.19	<0.19	0.31	<0.19	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
93COA17L	<0.04	N/A	<0.18	<0.18	<0.18	<0.18	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
93COA18L	<0.04	N/A	<0.18	<0.18	<0.18	<0.18	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
93COA19L	<0.03	N/A	<0.17	<0.17	<0.17	<0.17	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
93COA11L	<0.03	N/A	<0.17	<0.17	<0.17	<0.17	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
93COA20L	<0.04	N/A	<0.18	<0.18	<0.18	<0.18	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
93COA21L	<0.03	N/A	<0.16	<0.16	<0.16	<0.16	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
93COA22L	<0.03	N/A	<0.17	<0.17	<0.17	<0.17	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
93COA23L	<0.03	N/A	<0.16	<0.16	<0.16	<0.16	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
93COA24L	<0.03	N/A	<0.16	<0.16	<0.16	<0.16	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
93COA25L	<0.03	N/A	<0.16	<0.16	<0.16	<0.16	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
93COA26L	<0.03	N/A	<0.16	<0.16	<0.16	<0.16	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
93COA27L	<0.03	N/A	<0.16	<0.16	<0.16	<0.16	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
93COA28L	<0.03	N/A	<0.17	<0.17	<0.17	<0.17	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
93COA29L	<0.03	N/A	<0.17	<0.17	<0.17	<0.17	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
93COA30L	<0.04	N/A	<0.18	<0.18	<0.18	<0.18	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
93COA31L	<0.03	N/A	<0.17	<0.17	<0.17	<0.17	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
93COA32L	<0.03	N/A	<0.16	<0.16	<0.16	<0.16	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
93COA33L	<0.03	N/A	<0.17	<0.17	<0.17	<0.17	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
93COA34L	<0.03	N/A	<0.16	<0.16	<0.16	<0.16	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
93COA35L	<0.04	N/A	<0.18	<0.18	<0.18	<0.18	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
93COA36L	<0.04	N/A	<0.19	<0.19	<0.19	<0.19	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
93COA37L	<0.03	N/A	<0.15	<0.15	0.39	<0.15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
93COA38L	<0.03	N/A	<0.16	<0.16	<0.16	<0.16	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03

Appendix D (continued)

Bird ID No.	HCB	PCB Total	PCB-1242	PCB-1248	PCB-1254	PCB-1260	Alpha BHC	Alpha chlordane	Beta BHC	Cis-nonachlor	Delta BHC	Dieldrin	Ecdrin	Gamma BHC
93COA39L	<0.03	N/A	<0.16	<0.16	<0.16	<0.16	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
93COA40L	<0.03	N/A	<0.17	<0.17	<0.17	<0.17	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
93COA41L	<0.04	N/A	<0.20	<0.20	<0.20	<0.20	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
93COA6L	<0.03	N/A	<0.16	<0.16	0.55	<0.16	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
93COA7L	<0.04	N/A	<0.18	<0.18	<0.18	<0.18	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
93COA8L	<0.04	N/A	<0.18	<0.18	<0.18	<0.18	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
93COA9L	<0.03	N/A	<0.17	<0.17	<0.17	<0.17	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
02L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
03L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
04L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
05L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93COA42L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93COA43L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93COA44L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93COA45L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93COA46L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93COA47L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93COA48L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93COKR1L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94COSL1L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Bird ID No.	Gamma chlordane	Heptachlor epoxide	Mirex	o,p-DDD	o,p-DDE	o,p-DDT	Oxychlordane	p,p-DDD	p,p-DDE	p,p-DDT	Torophene	Trans-nonachlor	Comments
92COHS1L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93COA10L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.17	<0.03	
93COA11L	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.04	<0.04	0.04	<0.04	<0.18	<0.04	
93COA12L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.17	<0.03	
93COA13L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.16	<0.03	
93COA14L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	<0.17	<0.03	
93COA15L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	<0.16	<0.03	

Appendix D (continued)

Bird ID No.	Gamma-chlordane	Heptachlor epoxide	Mirex	α,p -DDD	α,p -DDT	α,p -DDE	Oxychlordane	p,p-DDD	p,p-DDE	p,p-DDT	Tetraphene	Trans-nonachlor	Comments
93COA16L	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.04	<0.04	<0.19	<0.04	22.22 RPD for PCB<1254; 58.67% spike recovery for HCB; 122.67% spike recovery for p,p-DDT
93COA17L	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.18	<0.04	
93COA18L	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.04	<0.04	<0.18	<0.04	
93COA19L	<0.03	0.03	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	0.07	<0.03	<0.17	<0.03	
93COA11L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.17	<0.03	
93COA20L	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.18	<0.04	
93COA21L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.16	<0.03	
93COA22L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.17	<0.03	55.56% spike recovery for HCB; 63.13% spike recovery for PCB<1254; 78.28% spike recovery for dieldrin; 141.41% spike recovery for p,p-DDT
93COA23L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.16	<0.03	
93COA24L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.16	<0.03	
93COA25L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.16	<0.03	
93COA26L	<0.03	0.03	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	<0.03	<0.03	<0.16	<0.03	
93COA27L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.16	<0.03	
93COA28L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.17	<0.03	
93COA29L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.17	<0.03	
93COA30L	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.18	<0.04	
93COA31L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.17	<0.03	
93COA32L	<0.03	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.16	<0.03	
93COA33L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.17	<0.03	
93COA34L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.16	<0.03	
93COA35L	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.18	<0.04	
93COA36L	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.04	<0.04	<0.19	<0.04	
93COA37L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.15	<0.03	
93COA38L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	<0.16	<0.03	
93COA39L	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.16	<0.03	

Appendix D (continued)

Bird ID No.	Gamma chlordane	Heptachlor epoxide	Mirex	α -p-DDD	α -p-DDE	α -p-DDT	Oxychlordane	p,p-DDD	p,p-DDE	p,p-DDT	Tetraphene	Trans-nonachlor	Comments
93COA40L	<0.03	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	0.03	<0.17	<0.03	
93COA41L	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.20	<0.04	
93COA6L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.16	<0.03	
93COA7L	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.18	<0.04	
93COA8L	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.18	<0.04	
93COA9L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.17	<0.03	
02L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
03L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
04L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
05L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
93COA42L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
93COA43L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
93COA44L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
93COA45L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
93COA46L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
93COA47L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
93COA48L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
93COKR1L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
94COSL1L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	

spectacled eider (*Somateria fischeri*)

Bird ID No.	HCB	PCB-Total	PCB-1242	PCB-1248	PCB-1254	PCB-1260	Alpha BHC	Alpha chlordane	Beta BHC	Cis-nonachlor	Delta BHC	Dieldrin	Ecdrin	GammabHC
91SPSL2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
91SPSL3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
91SPSL5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
92SPHS1L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
92SPHS2L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93SPBA1L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93SPHS1L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93SPHS2L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93SPKR1L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPHS1L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Appendix D (continued)

Bird ID No.	HCB	PCB-Total	PCB-1242	PCB-1248	PCB-1254	PCB-1260	Alpha BHC	Alpha chlordane	Beta BHC	Cis-nonachlor	Delta BHC	Dieldrin	Ecdrin	Gamma BHC
94SPHS2L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPHS3L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPK1L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPK2L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPSL1L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPD1L	<0.03	<0.14	N/A	N/A	N/A	N/A	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
94SPD2L	<0.03	<0.15	N/A	N/A	N/A	N/A	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
94SPD3L	<0.03	<0.15	N/A	N/A	N/A	N/A	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03

Bird ID No.	Gamma chlordane	Heptachlor epoxide	Mirex	α -p-DDD	α -p-DDE	α -p-DDT	Oxychlordane	β -p-DDD	β -p-DDE	β -p-DDT	Toxaphene	Trans-nonachlor	Comments
94SPSL2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPSL3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPSL5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPHS1L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPHS2L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPBA1L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPHS1L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPHS2L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPKR1L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPHS1L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPHS2L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPHS3L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPK1L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPK2L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPSL1L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPD1L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.14	<0.03
94SPD2L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.15	<0.03
94SPD3L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.15	<0.03

Appendix D (continued)

Steller's eider (*Polyysticia stellaris*)

Bird ID No.	HCB	PCB-Total	PCB-1242	PCB-1248	PCB-1254	PCB-1260	Alpha BHC	Alpha chlordane	Beta BHC	Cis-nonachlor	Delta BHC	Dieldrin	Ecdrin	Gamma BHC
92STTG1L	ND	ND	ND	ND	ND	ND	<0.02	<0.02	ND	ND	ND	ND	ND	ND
93STBA1L	<0.03	<0.14	N/A	N/A	N/A	N/A	<0.03	<0.03	<0.02	<0.02	<0.03	<0.03	<0.03	<0.03
93STBA2L	<0.03	<0.16	N/A	N/A	N/A	N/A	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
93STBA3L	0.03	<0.17	N/A	N/A	N/A	N/A	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
94STD1L	<0.05	<0.26	N/A	N/A	N/A	N/A	<0.05	<0.05	<0.05	ND	ND	<0.05	<0.05	<0.05
94STD2L	<0.06	<0.29	N/A	N/A	N/A	N/A	<0.06	<0.06	<0.06	ND	ND	<0.06	<0.06	<0.06
94STKO1L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Bird ID No.	Gamma chlordane	Heptachlor epoxide	Mirex	o,p-DDD	o,p-DDE	o,p-DDT	Oxychlordane	p,p-DDD	p,p-DDE	p,p-DDT	Tetraphene	Trans-nonachlor	Comments
92STTG1L	ND	ND	ND	<0.03	<0.03	<0.03	0.03	<0.03	<0.03	<0.03	<0.14	ND	ND
93STBA1L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.15	<0.03	
93STBA2L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.17	<0.03	
93STBA3L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	<0.03	<0.03	<0.17	<0.03	
94STD1L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.26	<0.05	
94STD2L	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.29	<0.06	
94STKO1L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	

Values are reported in parts per million (ppm) dry weight concentrations.

ND = No data

Appendix E:

Organochlorine residues found in eider kidney tissues

common eider (*Somateria mollissima*)

Appendix E (continued)

Bird ID No.	HCB	PCB-Total	PCB-1242	PCB-1248	PCB-1224	PCB-1260	Alpha BHC	Alpha chlordane	Beta BHC	Cis-monochlor	Delta BHC	Dieldrin	Ecdrin	Gamma BHC
93COA43K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93COA44K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93COA45K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93COA46K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93COA47K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93COA48K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93COKRK	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94COSL1K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
92COHS1K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93COA10K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.20	<0.04	<0.04	
93COA11K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.20	<0.04	<0.04	
93COA12K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.21	<0.04	<0.04	
93COA13K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.20	<0.04	<0.04	
93COA14K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.21	<0.04	<0.04	
93COA15K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.20	<0.04	<0.04	
93COA16K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.20	<0.04	<0.04	
93COA17K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.21	<0.04	<0.04	
93COA18K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.22	<0.04	<0.04	
93COA19K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.22	<0.04	<0.04	
93COA1K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93COA20K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.20	<0.04	<0.04	
93COA21K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.20	<0.04	<0.04	
93COA22K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.20	<0.04	<0.04	
93COA23K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.20	<0.04	<0.04	
93COA24K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.20	<0.04	<0.04	
93COA25K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.20	<0.04	<0.04	
93COA26K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.21	<0.04	<0.04	
93COA27K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.20	<0.04	<0.04	
93COA28K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.20	<0.04	<0.04	
93COA29K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.20	<0.04	<0.04	
93COA30K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.19	<0.04	<0.04	
93COA31K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.20	<0.04	<0.04	
93COA32K	<0.04	0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.21	<0.04	<0.04	
93COA33K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.21	<0.04	<0.04	
93COA34K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.18	<0.04	<0.04	
93COA35K	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.23	<0.05	<0.04	
93COA36K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.20	<0.04	<0.04	
93COA37K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.19	<0.04	<0.04	
93COA38K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.22	<0.04	<0.04	
93COA39K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.21	<0.04	<0.04	

70.18% spike recovery
for PCB<1254; 45.11%
spike recovery for endrin

Appendix E (continued)

Bird ID No.	Gamma chlordane	Heptachlor epoxide	Mirex	o,p-DDD	o,p-DDE	p,p-DDT	Oxychlorofane	p,p-DDDD	p,p-DDT	Toxaphene	Trans-nonachlor	Comments
93COA40K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
93COA41K	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
93COA46K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
93COA7K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
93COA8K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
93COA9K	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
02K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
03K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
04K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
05K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93COA42K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93COA43K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93COA44K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93COA45K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93COA46K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93COA47K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93COA48K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93COKR1K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94COSL1K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

*spectacled eider (*Somateria fischeri*)*

Bird ID No.	HCB	PCB-Total	PCB-1242	PCB-1248	PCB-1254	PCB-1260	Alpha BHC	Alpha BHC	Beta BHC	Cis-hexachlor	Delta BHC	Ecdrin	Gamma BHC
91SPSL1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
91SPSL4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
91SPSL6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
92SPHS1K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
92SPHS2K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93SPBA1K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93SPHS1K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93SPHS2K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93SPKR1K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPHS1K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPHS2K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPHS3K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPK1K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPK12K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPSL1K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
95SPD1K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
95SPD2K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
95SPD3K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Appendix E (continued)

Bird ID No.	Gamma chlordane	Heptachlor epoxide	Mirex	o,p-DDD	o,p-DDE	o,p-DDT	Oxychlordane	p,p-DDD	p,p-DDE	p,p-DDT	Toxaphene	Trans-nonachlor	Comments
91SPSL1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
91SPSL4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
91SPSL6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
92SPHS1K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
92SPHS2K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93SPBA1K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93SPHS1K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93SPHS2K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93SPKR1K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPHS1K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPHS2K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPHS3K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPK1K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPK2K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94SPSL1K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
95SPID1K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
95SPID2K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
95SPID3K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Steller's eider (*Polyysticia stellaris*)

Bird ID No.	HCB	PCB-Total	PCB-1242	PCB-1248	PCB-1254	PCB-1260	Alpha BHC	Alpha chlordane	Beta BHC	Cis-nonachlor	Delta BHC	Dieldrin	Endrin	Gamma BHC
92STTG1K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93STBA1K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93STBA2K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
93STBA3K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94STD1K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
94STD2K	<0.25	<1.24	ND	ND	ND	ND	<0.25	<0.25	<0.25	<0.25	ND	<0.25	<0.25	<0.25
94STKO1K	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Values are reported in parts per million (ppm) dry weight concentrations.

N/A = Not Applicable

ND = No data

Detection limits raised
due to insufficient sample
Detection limits raised
due to insufficient sample

